FEBRUARY 1996

GRASSROOTS INDICATORS *for* DESERTIFICATION

EXPERIENCE *and* PERSPECTIVES *from* EASTERN *and* SOUTHERN AFRICA

EDITED BY
HELEN HAMBLY AND TOBIAS ONWENG ANGURA

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

GRASSROOTS INDICATORS *for* DESERTIFICATION

EXPERIENCE *and* PERSPECTIVES *from* EASTERN *and* SOUTHERN AFRICA

EDITED BY
HELEN HAMBLY AND TOBIAS ONWENG ANGURA

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE
Ottawa • Cairo • Dakar • Johannesburg • Montevideo
Nairobi • New Delhi • Singapore

Published by the International Development Research Centre
PO Box 8500, Ottawa, ON, Canada K1G 3H9

February 1996

Legal Deposit: 1st quarter 1996
National Library of Canada

A microfiche edition is available

To order, please contact IDRC Books.
Mail: PO Box 8500, Ottawa, ON, Canada K1G 3H9
Phone: (613) 236-6163 ext. 2087
E-mail: order@idrc.ca

Our catalogue may be consulted on Internet.
Gopher: gopher.idrc.ca
World-Wide Web: http://www.idrc.ca

ISBN 0-88936-794-9

Contents

Part 3: Implications and Impact

Foreword

The need to monitor and evaluate sustainable development is a critical concern for many countries worldwide. This effort must be directed to understanding and identifying the significance, nature and characteristics of indicators devised from local knowledge and used in environmental decision-making and monitoring of environmental change.

In February 1995, Uganda hosted a workshop entitled "Measuring and Monitoring Desertification in Africa: The Role of Grassroots Indicators". It was organized in collaboration with the Makerere Institute of Social Research and the Eastern and Southern Africa Regional Office of the International Development Research Centre (IDRC). The workshop was attended by a total of 27 participants from Kenya, Tanzania, Zimbabwe and Uganda, as well as members of the Grassroots Indicators Network from India and Canada. Representatives of African and international non-government organizations (NGOs), research networks and the United Nations also attended.

The meeting on grassroots indicators was being held at an opportune time and an important location, as Uganda has been emerging from a traumatic past. Indeed, the country is at a crossroads: it must emulate successful development efforts but at the same time avoid certain obvious pitfalls. Because of this, efforts to promote and employ the concept of "grassroots indicators" is a topic of interest to Uganda as relationships between the state and civil society are rebuilt. This topic is also timely because of the controversy over the famine in the North and Northeast of Uganda, which occurred because of a failure to assess and monitor environmental change and food security in the region accurately. Grassroots indicators could well have been useful in predicting the famine and ensuring a prompt, targeted response. Reports based on remote sensing data and agricultural forecasts had claimed that there was no famine in the North. But the people at the grassroots, using their own indicators and knowledge of the environment and food resources in their region, had denied this report. Indeed, remote sensing data had failed to take note of local realities like vegetation change and rainfall distribution. As a result of this controversy, a Presidential Commission of Inquiry brought structural change to the measurement and monitoring of famine, drought, and desertification processes — on the basis of local evidence provided by farmers.

In the future, local people must be empowered to report their indicators directly to the local and national administration. In Uganda, this reporting may be possible through the local councils. Decentralisation legislation has been passed to strengthen this process of empowerment. NGOs can further support this process by urging the participation of the grassroots in all aspects of development planning and implementation. In this way, grassroots indicators can become an integral part of the democratization process currently sought in many parts of Africa. However, it is also necessary to bring policymakers into the research process if it is to benefit the local people. Leadership is a challenge and an obligation to do better: that is why, as an elected representative, one must help shape research and policy and make it relevant to the grassroots.

The Honourable David Pulkol
Minister for Karamoja, Republic of Uganda

Preface

"Knowledge is power" has become a common but true cliché in development research. As two sides of the same coin, "sharing knowledge" and "power sharing" lie at the root of problems like desertification and drought. The potential of working with "grassroots indicators" as a method and outcome of knowledge sharing may lead to new possibilities of creating new and more accurate forms of development indicators, planning and monitoring processes. This approach would also facilitate local control over the generation and use of knowledge.

The papers in this volume are just such an attempt to share knowledge and power. The individual and group efforts it represents date back to 1993, when the Environment and Natural Resources Division of IDRC organized a preliminary brainstorming meeting on the topic of alternative development indicators, or what became known as "grassroots indicators." The meeting's proponents, Anne Whyte, Joachim Voss, Yianna Lambrou, David Brooks, Danna Leaman, Helen Hambly and Michelle Lobo were informed and challenged by the work of researchers such as Henry Lickers, Anil Gupta, Elizabeth Ardayfio-Schandorf and the work of organizations such as the World Conservation Union (IUCN) and the Institute for Low External Input Agriculture (ILEIA). These individuals and others formed the initial Grassroots Indicators Network (GRIN).

In 1994–95, an opportunity arose to bring the topic of grassroots indicators into the specific context of natural resource management in Eastern and Southern Africa. The focus of this regional approach was IDRC's involvement in supporting and ensuring that NGOs and researchers working at the grassroots level had "voice" and input into the International Convention on Desertification process. The subsequent meeting in Mbarara, Uganda and the formation of the Africa Grassroots Indicators Network (AGRIN) led to the development of the papers in this book. This activity would not have been possible without the support of the Eastern and Southern Africa Regional Office of IDRC and in particular, Hartmut Krugmann and conference coordinator, Monica Opole. The unique commitment of the Honourable David Pulkol, Minister of Karamoja, and the capability of the Makerere Institute of Social Research (MISR) deserve special mention. David Brooks, Sam Landon, and Bill Carman made sure that these papers and key points of our discussions were available to a much wider audience. To all these individuals and institutions we offer our thanks and appreciation.

Grassroots indicators are defined here as measures or signals of environmental quality or change formulated by individuals, households, and communities, and derived from their local systems of observation, practice, and indigenous knowledge. As the papers in this book maintain, grassroots indicators should play a key role in the implementation of global agreements such as the Desertification Convention because they are critical for local-level evaluation and reporting on environmental change. Grassroots indicators can serve to augment national and regional environmental monitoring systems both temporally and spatially. Through them, local people can collaborate with scientists and researchers to improve desertification and drought indices, and so contribute to the effort of finding a solution to these global problems.

H.H. and T.O.A.
October 1995

INTRODUCTION

Helen Hambly

Development indicators, as instruments to measure and monitor economic and social change, are essential tools of the development trade. Traditionally the working stock of statisticians, economists, senior planners, and policy-makers, development indicators, and sets of indicators or indices, are now subject for debate among a much wider group of development researchers, managers, and practitioners. This opportunity has been opened up by the emergence of social equity and environmental sustainability issues in the development agenda, but more importantly, by a fundamental re-examination of *who* defines "development" and evaluates environmental change.

Some international agencies have accepted the challenge to revisit and reformulate development indicators. The World Resources Institute (WRI 1991), for example, has broadened its definition of the term by incorporating natural resource management variables. The Human Development Index of the United Nations Development Programme (UNDP) is one of the best-known efforts to devise a more comprehensive set of development indicators that include social as well as economic factors. Still, the validity of these measures and their applicability over time have been questioned by agencies which continue to urge the development of more accurate and relevant development indicators (Westendorff and Ghai 1993).

This book starts out from a different standpoint. It argues that the conventional measures and standards associated with the planning, monitoring, and evaluation of research and development projects have tended to be dominated by Euro-American scientific perceptions of environmental and development change using "top-down" approaches to data collection and analysis. The overall objective of this book, as well as the project supported by the International Development Research Centre which led to the drafting of these papers, is to draw attention to the subject of "grassroots indicators": *measures or signals of environmental quality or change formulated by individuals, households and communities, and derived from their local systems of observation, practice and indigenous knowledge.* The "environment" is defined here in its widest sense to cross economic, social, cultural, and ecological boundaries, and therefore seeks to open up the rigid sectoral approach typically used to delineate environment and development indicators.

Local knowledge and capacity to monitor and measure environmental change are an important and valid basis for development indicators, for three main reasons. First, local knowledge systems offer an alternative approach to interpreting environmental and development change. Entering this learning process will instruct and improve development policy and action at the local, and possibly at the national and regional planning levels. For example, even though there is ample evidence to suggest that traditional systems of land use in dryland Africa are more sustainable than previously recognized, development interventions through desertification control planning and implementation have ignored substantial local capability for assessing and reporting short- and long-term changes in these environments.

The second motive for a focus on grassroots indicators is to transform what has commonly been referred to as "proxy indicators": field-level indicators identified and applied by outsiders, and often regarded as a quaint but inferior surrogate to "scientific" indices. Yet grassroots indicators can be a far more powerful tool to identify, and possibly predict, environmental change. Most importantly, grassroots indicators are a method, and an outcome, of upholding and safeguarding local knowledge. In effect, local people make decisions using, at least in part, their own tools for monitoring and measuring problems such as land degradation, and therefore they interpret and act on their own understanding of "sustainable development."

A third reason for illuminating the importance of grassroots indicators is to work towards the disintegration of what has been referred to as the "three solitudes" of policy, research, and action.[1] This process would involve conceptualizing research in terms of learning and action that combines secular and moral domains of thought; also taking into account policy as structures and procedures which may inadvertently or deliberately maintain barriers between the "three solitudes." Grassroots indicators are therefore part of a more responsible form of development research, generating and sharing information which will recognize and support local knowledge and innovation.[2]

[1] I am using a phrase and argument presented to the Workshop on Measuring and Monitoring Desertification in Africa: The Role of Grassroots Indicators, by Dr. Anne Whyte, Director General of the Environment and Natural Resources Division, IDRC, Ottawa.

[2] The protocol for research on grassroots indicators was developed in 1993. It was subsequently discussed and endorsed, with modifications, by the Eastern and Southern Africa Regional Workshop. This version appears in the Appendix.

Desertification and Development

The June 1992 United Nations Conference on Environment and Development (UNCED) Earth Summit in Rio de Janeiro ushered in a new era of awareness and global deliberations on environment and development issues. The discouragement with the progress towards addressing the debates and outcomes of this global forum is well known; three years later, the implementation of even preliminary agendas appears to be an overwhelming task.

One of the key areas for African delegates at the Earth Summit was the twin issue of drought and desertification. Desertification is estimated to involve most of the world's drylands: 3.6 billion hectares of land in total, or 25 percent of the world's surface area. This includes 73 percent of the world's rangelands, 47 percent of rain-fed agricultural land, and 30 percent of irrigated cropland. Desertification affects some 900 million people globally (Koala et al. 1994). Efforts to address desertification and drought have not been successful because of a variety of institutional, political, economic, and logistical problems. The widely publicized failure of the first plan of action to combat desertification (PACD) of the 1977 UN Conference on Desertification left little doubt among the representatives attending the Earth Summit that a new plan of action for desertification and drought must be negotiated, and that strategies must be made regionally specific.[3]

The Desertification Convention began in 1993 and was concluded in 1994. The final text of the Convention adopted UNCED's basic definition of desertification as "land degradation in arid, semi-arid and dry subhumid areas, resulting from various factors, including climatic variations and human activities (UNCED 1992 and UN 1994)."[4] Unfortunately, despite the growing seriousness of desertification, the Convention also inherits some of the same difficulties of mobilizing resources and action which have characterized the PACD and the post-UNCED period. Observers and participants in the Desertification Convention process continue to seek new ways of rethinking and approaching these issues.

[3] Regional action plans for Africa, Latin America, Asia, and the Northern Mediterranean are included in the Regional Implementation Annex of the 1994 Convention.

[4] Agenda 21: Programme of Action for Sustainable Development and the United Nations Convention on Desertification, Article 1 a) and f).

Two of the most crucial requirements for desertification abatement, as outlined by the recent Convention, are the improvement of information systems to review and measure ecological, economic and social consequences of desertification, and the transformation of results and recommendations to policymakers into action-oriented programs. Non-governmental agencies have supported these aims but have warned against the tendency towards centralized information systems and a continuing lack of popular participation in decision-making about desertification control activities (ELCI 1994).[5]

The paramount importance of local involvement in all desertification control programs has been recognized by many governments as well as the United Nations; but the inclusion of grassroots voices has been a challenge unmet in Eastern and Southern Africa. Even recent work by the UNDP on desertification indicators has not given enough attention to those based on local or indigenous knowledge (Ridgeway 1995). Methods to determine and calibrate indicators remain fundamentally unchanged. Part of this problem lies in the danger of fitting locally used indicators into an analytical framework designed to sever the indicator from both its context and its contributors. The other part of the problem, and perhaps the greater challenge, lies in enduring suspicions and prejudices against local knowledge and its value to "scientific" measurements of desertification. Given the dismal track record on desertification abatement and information flows, however, which many governments openly admitted at the Desertification Convention, grassroots indicators may well have a substantial role to play in the monitoring and evaluation of desertification, as well as in the efforts to reverse land degradation.

As the papers in this book attest, grassroots indicators research and development-related activities have a significant contribution to at least five implementation objectives of the Desertification Convention: 1) better information systems that draw on the people's accrued knowledge of the environment; 2) mobilization of local people, organizations, and resources; 3) better planning and implementation of antidesertification strategies; 4) clarification of causes and solutions to land degradation; and 5) reporting on progress towards sustainable local and national development.

[5] RIOD (*Réseau International d'ONG sur la Désertification*), an international NGO network on drought and desertification, has made similar points.

Grassroots Indicators and Desertification in Eastern and Southern Africa

The nature and extent of desertification in Africa differs from area to area even within regions, although underlying problems may be similar. This book is based on a collection of papers on Eastern and Southern Africa, two subregions of the world which have experienced repetitive drought and have been increasingly prone to desertification because of precarious social, economic, political and ecological conditions.

Part 1 deals with the historical and contextual background of development and desertification indicators. Mascarenhas outlines the "crisis of development" as we know it today. He traces the roots of the current dissatisfaction with efforts to measure and monitor development (or maldevelopment) in semi-arid and arid regions of Africa. The failure of development makes the example of the Maasai's use of "grassroots indicators" in environmental management even more important. Introduced here by Mascarenhas, this example is further debated and developed by the contributions of Krugmann, as well as de Vreede (Part 2) and Kipuri (Part 3). Each case study of Maasai "grassroots indicators" demonstrates the richness and diversity of indicators used by pastoralists and agropastoralists, and the divergent views on the reliability and usefulness of these grassroots indicators.

Today's need for improved desertification indicators is the outcome of a long history of a) efforts to improve the scientific methodology and analysis of the underlying causes and symptoms of drought and desertification, and b) work to develop better interventions and technologies to address these problems. As Krugmann explains, these methodologies and technologies have been externally generated for the most part. The possibility that indicators and data could be generated locally has been overlooked. To involve local people in the collection of ground-level information to reduce costs of desertification monitoring and improve information flows between scientists and communities: these are important arguments for using the grassroots indicators approach.

Reconciling the different attitudes and worldviews held by scientists and local people may be difficult, but not impossible, according to several of the authors in this volume. Some have suggested that combined indicators, or at least associated indices, deserve greater attention. Often referred to as "hybrid" or "merged" indicators, they represent a kind of initial work-in-progress attempting to cross-

fertilize scientific and grassroots indicators. Orone cautions that the merger between scientific and grassroots indicators can only be applied within a decentralized, participatory research and planning process. On this basis, the present context of development in Uganda is especially interesting. This argument is also taken up later, in Part 3, by Tobias Onweng Angura. These two Ugandan researchers suggest that the decentralization process currently underway in their country could provide the right political and administrative climate to establish these changes. Yet the authors also agree that these changes require work which, for the most part, still moves against the mainstream of conventional development practice.

How, then, can the built-in biases of mainstream development be overcome so that it can come to appreciate and incorporate local knowledge? This is certainly a legitimate question. To seek an answer, Part 2 deals with changes in the methodologies and thinking needed to identify grassroots indicators better and to help local people determine the "sustainability" of their natural resource management. Lubowa suggests that the local cosmology or belief systems, and the remnants of ancient beliefs are important to the formation and use of grassroots indicators. Mwesigye considers the gap between the scientific and traditional worldviews and its manifestation in language, including the translation of concepts such as "environment" and "indicators." Understanding the communication gap between indigenous and exogenous knowledge systems is the goal of development programs like those described by Kinyunyu and Swantz as well as de Vreede. These two papers provide enlightening approaches to the subject of bridging the "three solitudes" of research, action and policy. Indeed, the divide is not so much a question of finding the perfect grassroots indicators, as one of using indicators as a focus for community participation and empowerment. They conclude that the methodological basis of grassroots indicators may have the most significant impact on efforts to reverse land degradation.

This book has succeeded in illuminating a wide range of examples of grassroots indicators and the initial attempts to conceptualize indices across and within the countries of Kenya, Uganda, Tanzania, and Zimbabwe. Thus in Part 3, on the overall impact of grassroots indicators, Mwadime compares examples of indicators from two communities in different districts in Kenya. His research challenges policymakers concerned with desertification to think beyond indicators of natural

resource degradation to indicators of food insecurity, which simultaneously degrade human health and nutrition and force local people into unsustainable livelihoods. Kipuri also highlights this inseparable link between health and environmental indicators by demonstrating the interdependency of human and livestock health with ecological diversity and conservation in Maasailand.

Evidence from Mwadime's ongoing research and the work of Oduol and Kipuri suggest that grassroots indicators can be interpreted as a catalyst for local action and adaptive change at both the community and household levels in semi-arid and arid areas. Pastoralists such as the Maasai have had to be particularly adept at developing survival strategies through the use of a wide range of grassroots indicators to predict change and stimulate actions. Similar response mechanisms are also found among agropastoralists and agriculturalists. The best reason for maintaining grassroots indicators and survival strategies may in fact be the failure of alternatives, including mainstream development programs. Yet, as Mararike explains in the final paper of the book, the prevailing existence of local knowledge and "grassroots indicators" does not guarantee the reproduction of the necessary knowledge base, nor is there any guarantee that the environment in which grassroots indicators have evolved will not deteriorate more quickly than the local knowledge systems can be protected and shared.

This page intentionally left blank

PART 1

CONTEXT AND CONCEPTS

This page intentionally left blank

An Historical Perspective on Indicators in Development Studies and the Need for Critical Reassessment

Adolfo Mascarenhas

Introduction

As we approach the twenty-first century, it is becoming more and more obvious that although there have been some very dramatic changes, the goals of development will have to be revisited, especially in Africa. With the formal end of the Cold War there has as yet been no dividend from the assumed peace. Despite the rigid economic reforms proposed by the international financial institutions (IFIs), Africa is sinking into an economic and political quagmire. Despite all the notions of "one earth" emerging from the World Commission on Environment and Development (WCED), the tangible evidence for the healing processes are not in place, and the promises made at the Earth Summit in 1992 are beginning to wear thin (WCED 1987).

All issues and problems in Africa have been reduced to a common denominator, with economic reform touted as the panacea. Indeed, the economic reforms of this decade have brought a whirlwind of change: their impact is as profound and far-reaching as the changes during the decade of African independence. The structural adjustment programs designed by the IFIs will probably herald even more crushing indebtedness, civil strife, anarchy and the near-enslavement of the majority who are poor. Reforms have actually meant that there is greater disparity between the rich and powerful on one hand, and the poor and powerless on the other.

While Africa's leaders are faced with a catastrophic economic crisis, it is apparent that the solution lies not so much in the economic as in the political domain. The silence of the masses against their leaders is now slowly being broken. There is spontaneous reaction and pent-up frustration: "... Is there any country in Africa which is not experiencing rioting, protests, university closures, campaigns for multi-party democracy or public opposition to the work of the IMF and the World Bank? A profound sense of dissatisfaction pervades Africa..." (Turok 1991).

The Evolution of Development Indicators

Two events, more than any others, have shaped the evolution of development as we know it and the indicators or measures used to describe Third World development: the Great Depression of the 1930s and the subsequent World War, which led to the emergence of international institutions directed at global reconstruction. Since most Third World countries attained their independence after World War II, it is not surprising that European and North American models for measuring development have generally prevailed.

The Great Depression played havoc with the majority of workers in Europe and America. The first social impact reports had recognizable social indicators (SIs) and these were very successful, especially in North America. At a time when the magic of the market proved to be a cruel mirage, governments intervened in various ways and the welfare state entered in defense of the downtrodden.

Social indicators did not come into common usage again until the mid-1960s. Quantitatively inclined political scientists tried to provide comparative material for several statistical variables (Russet 1964). The big emphasis came after the publication of *Social Indicators*, a volume produced for the National Aeronautics and Space Administration (NASA), on the methodological issues of collating development indicators (Bauer 1966). How useful the studies were to NASA is unknown; however, they certainly generated a great deal of interest. The use of SIs to influence the postindustrial future expanded the use of the SI approach. A number of sponsoring agencies in the United States and Europe encouraged further research. Furthermore, as the the SI movement was gaining momentum, the economic or market approach to development was also in the ascendant.

The Bretton Woods institutions were created largely to finance the rebuilding of a devastated Europe, especially factories and infrastructure. During the war, European governments had literally taken over national industries such as iron and steel production, vehicle manufacturing, ship building, and coal mining. Governments, therefore, had to play a major role in returning the industries to the market rather than rebuilding the social wreckage of the war. Inevitably, economic performance was given prominence in the system of national accounts.

With the confidence brought about by the rapid progress of reconstruction in Europe and with growing "First World" prosperity in the 1950s and 1960s, the IFIs and the industrialized countries assumed that economic growth was secured, and that the main challenge for the state was therefore to improve the global quality of life. As the IFIs moved into the "Third World," the basic thinking on economic growth remained within the European perspective — but without the same resources. In addition, the IFIs continued the colonial tradition of advising African countries to build their future on the exports of primary agricultural crops and minerals (Brown and Teffen 1992).

It will take a long time for the IFIs to adjust to the real situation in the Third World. African countries had not suffered from the destruction Europe had, yet both the departing colonial powers and the leaders of the emerging nations assumed that the key to development was to follow in the footsteps of the industrialized North, and therefore to focus on "modernization." The top priority, therefore, was to build basic infrastructure, agriculture had to be transformed, and the lack of industries became a crisis. In this modernization model all one had to do was to measure the gross domestic product (GDP) or gross national product (GNP) to determine national wealth, or rather the lack of it. There was a major flaw in this argument, however: the history and circumstances of development in Africa were very different from those of Europe.

The World Bank eventually conceded that development strategies worsened economic inequalities, but argued forcibly that the latter could be avoided by paying attention to redistribution (Chenery 1974). Policies could be formulated after mapping poverty profiles using SIs which would identify the affected groups and the scale of the problem. After twenty years of experimentation, this model is still being foisted on African countries. In the above "GNP-growth-plus-trickle-down model" the question, "Growth for whom?" was rarely asked. When the model was applied to rural areas, it tended to stress technical fixes and concentrate on the entrepreneurial class of farmers in more resource-endowed areas (George 1990). Basic issues, like returns to labor, were blatantly ignored.

An alternative to the World Bank model was the "correction of the dependency" one, under which the centre had exploited the periphery, which meant that as long as the historical imbalances of unequal exchange continued, the Third World would continue to be impoverished. Once again, little was achieved despite ideas

of the new international economic order (NIEO), a recommendation of the United Nations Committee for Trade and Development, the Brandt Commission and the Group of 77. Ten years of dialogue between North and South have not helped to bring harmony between them. Indeed, it is argued that even if there were harmony between states, there is little *within* the countries themselves. As George (1990) correctly points out, increased national revenues do not benefit the poor even in rich countries: it is illusory, therefore, to think of them as a solution to underdevelopment.

As the "modernization theory" and the market mechanism began to be criticized, serious questions began to be asked about the ecological limits of growth promulgated by the Club of Rome. The Beriloche Model, unlike other computer models, "... did not so much seek to predict the consequences of present trends, as to demonstrate the material viability of a desirable future (Miles 1985, p. 154)."

The work on basic needs started by the Beriloche Institute in Argentina was followed up and promoted by the International Labor Organization (ILO) as the "Basic Needs Strategy of Development" (ILO 1992). The concept is simple and robust, and reaches to the core of human development. The basic needs approach was used widely in Africa. However, it gave the impression of being deprivation-based — there was noting in it about the "higher needs" or "growth" of society.

Human Development Indicators

By the end of the first development decade in 1960, there was widespread disillusionment with the conventional measure of development — the "GNP Approach." The developed world was far from perfect, material progress was increasingly divergent and developing countries were gaining many of the social problems of the industrialized countries with few of the material benefits. Instead of blindly imitating the developed world, the idea of Human Development became an attempt to

> ...conceive of a contemporary alternative to maldevelopment — and an alternative that is anchored in the real world rather than drifting in the oceans around some Utopia...the aim is to map out an alternative that reflects the dynamism of real-world processes...and the rich potentials of humanity rather than the frozen configuration of a blueprint for an ideal social order (Miles 1985, p. 10).

Nevertheless, information was still needed on social parameters such as poverty. For some time, the main measure of hardship or poverty continued to be unemployment. Yet in the rich countries, poverty with state-provided unemployment benefits takes on a very different meaning from that prevailing in the Third World. There, poverty is frequently an undignified and inhuman struggle for the very basics of survival.

Market values, which usually shape development models, generally threaten many aspects of well-being and the quality of life. Unlike the unimodal economic or GNP approach to development, Human Development is multidimensional and can have political, cultural and even economic facets. It places human beings, rather than business, at the centre of the development process.

There have been other approaches to development and indicators often attempting to modify and depart from the GNP approach. The Physical Quality of Life Index (PQLI) incorporates variables of infant mortality, life expectancy and literacy. Indices of "ecodevelopment" have focused on the environment apart from the four key societal needs: production, reproduction, communication and political authority. The World Bank and UNDP Annual Development Reports each evaluate development and make future projections based on information for which development indicators are central. The former has provided attractive presentations of human resource data concerned with economic development, while the latter has emphasized the human development of member states.

Other agencies of the United Nations have been particularly concerned with the topic of development indicators. In the late 1960s, the United Nations Research Institute for Social Development (UNRISD) began to publish the results of its research program on standards of living. The first report showed the influence of living standards on economic growth and came to the conclusion that poverty in developing countries inhibited economic development (Scott 1978). The study was a breakthrough, in the sense that it reversed the conventional approach by using poverty, not economy, as the starting point. UNRISD has continued to pay attention to various development issues, and in recent years has produced important reports on the impact of reform on different segments of society.

Another UN approach relevant to the topic of indicators was the Goals, Processes and Indicators of Development (GPID) Project of the United Nations University

(UNU). The initial ideas of the GPID Projects were proposed and developed by John Galtung (1976). The UNU Project could not have come at a better moment. By the 1980s the rich had become richer, the superpowers had accumulated unimaginable arsenals of mass destruction and the planet had begun to gasp for breath. Clearly, living in a polluted environment, compounded by insecurity and poverty we have been witnessing not development, but maldevelopment. In response to this crisis and the need for diversity in thinking, the GPID project drew its members from the political "right," "left," and "centre," as well as from the East, West, North, and South, to discuss the future of human development. "Human development refers to the development of human beings in all life stages and consists of a harmonious relationship between persons, society and nature, ensuring the fullest flowering of human potential without degrading, despoiling or destroying society or nature (Galtung 1978)."

Nearly all the twenty-three member institutions involved in the GPID were dubious about the use of GNP as a measure of development and its relation to a process of development based on industrialization and modernization. The fundamental questions therefore became: What were the goals of different communities? What were the processes that could lead to different paths to development? Clearly, with such a large and diverse group, there were confrontations and serious disagreements over these questions. There was no attempt towards a UN-type of compromise. The views were so divergent that the UNU published only a few of the more than 20 books that emerged from the group. Many of these reports drew attention to the breadth of emerging global crises and called for an examination of local efforts and a range of indicators not considered by conventional development models. These included individual and community security, as well as the place of beliefs and religion in development.

The Age of Market Reform and Development

Since the 1980s, most African states have increasingly found themselves economically and politically beleaguered. This cannot neglect the fact that African governments have often accepted the need for fundamental revisions in their approach and strategies for development, as evidenced by the Lagos Plan of Action which was subsequently worked into the World Bank's *Agenda* (Adedeji and Shaw 1985). Few serious ideas and actions to accelerate development are

being proposed. In the power vacuum arising out of exhaustion and mismanagement, the IFIs have imposed their orthodox economic recommendations with such impunity that there have been setbacks even in areas where there had been some progress, like education — although it is true that some degree of reform has been necessary.

Since the decade of "economic reforms" designed by the IFIs and assisted by the donor community, the main priority has been a common economic approach to solving problems. Basically, the main aims of these reforms have been to eliminate economic distortions like overvalued currencies, fiscal deficits in the public sector, restrictions of local and foreign trade, retrenchment of inefficient and perhaps even corrupt public services and the mobilization of resources to stimulate growth (Hussain and Faruqee 1994). At the same time, there is now a steady flow and dissemination of well-orchestrated and uncritical information. Fortunately, there is also a trickle of refreshing viewpoints challenging the smugness of economic and environmental assumptions.

The initial research on the IFI reforms or structural adjustment programs (SAPs) was more concerned with macroeconomic impacts. These were later followed by emphasis on social welfare issues, which were replaced in turn by governance and national adjustments in relation to socioeconomic changes (Gibbon 1993). The main effects of SAPs have been a major decline in the social well-being of the majority, limited progress toward expected reforms, and economic results which have not lived up to the claims originally made. As poverty strengthens its grip in sub-Saharan Africa it is increasingly becoming evident that both "political capacity" and "political commitment" are required for redistributive change to eradicate absolute poverty (Adelman 1986).

Despite the often sharp divergence in orientation between the various observers, there is a surprising degree of agreement about the trends and impacts which accompany adjustment efforts. With very few exceptions, most African states appear to have abdicated their responsibilities and even the word "development" seems to have almost disappeared from usage. The time has come, therefore, to once again reconsider "development" and its indicators.

People's Development Indicators in Semi-Arid Areas

There are good reasons for focusing this paper on new approaches to development indicators and, in particular, their application to arid and semi-arid areas. Over the last twenty-five years, there have been at least four massive famines — two in the Sahel Region and two in the Horn of Africa — which have caused enormous loss of life and had devastating impacts on both people and governments. Development indicators used in Africa also tend to have an urban bias, and at best only consider the interests of rural agriculturalists. Pastoralists and other land users are generally excluded from consideration, and there is a tendency to regard their presence as detrimental to development and conservation.

Problems arise because there are several false assumptions made about the inability of the pastoralists to manage their own resources. The question of scale and the sharing of common resources has simply not been given enough attention. In the case of pastoralism, it is assumed that the range would be destroyed (Hardin 1968).[6] Little attention has been paid to the density of population or community-based organizations and knowledge which provide a safety net for the less privileged. The basic problem seems to be the refusal to accept that people can have alternative development goals.

One of the main development approaches to affect pastoralists is their sedentarization. The repercussions of this policy can be very negative. The Maasai, for instance, have been progressively dispossessed of their land by the greed of others. Farming on small plots in the drylands with inadequate knowledge of agriculture means that the failure rate, which is already high among the sedentary people, will spell disaster for the Maasai who opt to be peasants. The agricultural husbandry of desperately poor people is notoriously damaging to the ecosystem. A recent study attempts to show the intensity of competition between agriculture and pastoralism in the drylands at the expense of the resources and interests of the Maasai themselves (Mascarenhas 1993).

One of the distinguishing features of the conventional development indicators is that they were externally oriented, especially in their value system. They assumed that local people had no perception of their own needs, and that communities did

[6] The assumptions are the classic tragedy of the commons, despite the author's caution.

not distinguish, for example, between richer and poorer members of their community: yet local indicators reject this bias. Above all, most conventional indicators were simplistic about resource management and generally very silent about environmental dimensions. For instance, despite all the rhetoric, there is very little known about who the poor are, or the impact of poverty on the environment (Cooksey 1994; Mascarenhas 1994). In the case of Tanzania, as much as 30 percent of the population's informal activity does not enter the national statistics (Maliyomkono and Bagachwa 1990).

A good starting point for community-based development indicators in the arid and semi-arid areas is that most households stress self-reliance. Because of this, communities like the Maasai can contribute a great deal to development indicators, and to three areas in particular. The first is their concern for the environment, knowledge of environmental indicators and their efforts to manage the environment on a sustainable basis. Second are their poverty indicators, based on possession of livestock, which represents wealth, a basis of survival, and guidelines for social obligations. For instance, among the Maasai, four or five traditional household wealth categories have been identified (Muir 1994; Potkanski 1994).[7] Third is the existence among pastoralists of an immensely varied and rich traditional knowledge system (Niamir 1990). But the situation is changing as the semi arid-areas attract new groups of people. How will all of the various interest groups be accommodated? Can a common "development" in fact take place? For it remains true that "after almost half a century of development activities in the arid and semi-arid lands of Africa, we are no closer to finding solutions...(Niamir 1990, p. 3)."

Finding solutions is the challenge to which this book is directed.

[7] The categories were as follows: a) wealthy – many cattle, wives, children, and in a position to help the poor; b) average – enough cattle to be self-sufficient, greater number of small livestock; c) poor – insufficient cattle or only small livestock; d) very poor – no cattle or few small livestock; and e) destitute – no livestock.

Towards Improved Indicators to Measure Desertification and Monitor the Implementation of the Desertification Convention

Hartmut Krugmann

Introduction

This paper briefly examines earlier work on desertification assessment and indicators. It reviews the framework of the Desertification Convention and what it says about the use of indicators in desertification monitoring and reporting, with a view to characterizing the kinds of indicators needed to monitor its implementation. A number of general characteristics of possible desertification indicators are listed and an example of the classification of potential local indicators are provided from research conducted by the author in Rombo Location in Kajiado District, Kenya.

Indicators and Plan of Action to Combat Desertification

The severity and widespread occurrence of the problem of desertification was formally recognized for the first time in 1977 at the United Nations Conference on Desertification (UNCOD). This meeting conceived a Plan of Action to Combat Desertification (PACD) which was pursued between 1979 and 1991. The importance of assessing and monitoring states and processes of desertification at local or higher levels was recognized under the PACD and pursued in the 1980s by the Food and Agriculture Organization (FAO) and the United Nations Environment Programme (UNEP), who developed a provisional methodology for assessment and mapping of desertification (PMAMD). The methodology has been tested and adapted through two pilot projects (Kharin 1990).

One included a field test of the methodology in two districts of Western Mali which defined four types of land degradation processes: vegetation cover, wind erosion, water erosion, and soil compaction. For each, FAO/UNEP criteria were adapted to fit the local conditions. Methods for desertification mapping based on remote sensing were then applied to generate larger-scale maps on the present state of desertification, desertification rates, and desertification risks.

The other project was carried out by the Government of Kenya (GOK) Department of Resource Surveys and Remote Sensing (DRSRS), and UNEP. It focused on two field areas: the Lake Baringo and Marsabit Districts in Kenya (Ottichilo et al. 1990), and concluded that most of the indicators proposed by the FAO/UNEP Provisional Methodology could only be used at the local, or pilot level, because the costs of using the indicators and methods for assessment and mapping of desertification at the regional and national levels would be prohibitive, and the process time-consuming. The study had used a combination of remote sensing techniques and field surveys to collect data on selected desertification indicators. Detailed data were evaluated for use at the local level. Selected data elements and other data were used in a geographic information system (GIS) to develop generalized models for application at regional and national levels, including separate models for water erosion, wind erosion, range carrying capacity, vegetation degradation, and human population.

Recommendations of the Baringo-Marsabit study included: a) the use of remote sensing techniques as cost-effective, rapid, and also conducive to periodic data acquisition, for national-level assessment; and b) the inclusion of socioeconomic data in any assessment of desertification. Table 1 reproduces the list of physical, biological and socioeconomic desertification factors selected from the sets of indicators proposed by the FAO/UNEP Provisional Methodology. Table 2 presents the list of composite indicators which the authors constructed from the selected desertification factors, and also indicates the level of application of the indicators (local or national).

One immediate conclusion can be drawn from the FAO/UNEP projects: all of the chosen indicators are scientific — generated externally, for local or national use. Locally generated grassroots indicators are not considered at all; nor is the possibility of involving local people in the collection of scientific or grassroots data at the local level to reduce costs and time demands.

Table 1. Desertification Assessment Factors

Type and subtype of indicator		Factors
Physical	**Climatic**	a. Rainfall b. Temperature c. Wind speed, direction and frequency d. Rain erosion potential (calculated) e. Sunlight duration f. Potential evapotranspiration — PET (calculated) g. Sandstorm/dust storm h. Vortices
	Soils	a. Surface status (rockiness) b. Texture c. Fertility (organic matter) d. Structure e. Permeability f. Erosion potential (calculated) g. Alkalinization/Salinization h. Soil unit map
	Topography	a. Slope
Biological	**Vegetation**	a. Canopy cover of herbaceous and woody plants (%) b. Aboveground biomass production (standing crops) of herbaceous/woody cover (kg/ha/yr) c. Plant composition and desirable or key species d. Potential herbaceous production (calculated) e. Vegetation unit map
	Animals	a. Animal population estimates and distribution b. Herd composition c. Herbaceous consumption (calculated)
Socioeconomic	**Land and water use**	a. Land use b. Fuel wood consumption c. Water availability and requirements
	Settlement patterns	a. Settlements b. Infrastructure
	Human biological parameters	a. Population structure and growth rate b. Measures of nutritional status c. Feeding habits
	Social process parameters	a. Conflicts b. Migration c. Transhumance d. Environmental perception

Table 2. Desertification Assessment Indicators

Indicators	Level of application	
Physical	**Climate**	
	a. Aridity index	L,N
	b. Rainfall variability	L,N
	c. Wind deposition and deflection areas	L
	d. Wind erosion potential (calculated)	L,N
	Soil	
	a. Crusting and compaction	L
	b. Soil salinization/alkalinization	L
	c. Water erosion areas	L
	d. Water erosion potential (calculated)	L,N
Biological	**Vegetation**	
	a. Vegetation degradation (herbaceous and woody) — (calculated)	L,N
	b. Range carrying capacity (calculated)*	L,N
	c. Desirable and undesirable plant species	L
Socioeconomic	**Human factors**	
	a. Human settlements	L,N
	b. Land use	L,N
	c. Fuelwood consumption (calculated)*	L,N
	d. Nutritional status	L,N
	e. Migration	L,N
	f. Environmental perception	L

L = Local
N = National
* These were not undertaken in this study.

The Desertification Convention and Indicators

The 1994 Convention on Desertification is to be implemented through various national and subregional action programs. The Convention text outlines the content of these action programs and describes the institutional mechanisms that are to be used to develop and implement the action programs.[8] The Convention's approach to combating desertification (and mitigating the effects of drought)

[8] See Articles 10-15 of main Convention text as well as Articles 8-13 of the Regional Implementation Annex for Africa.

emphasizes the importance of local action by local people and communities. Clearly, the war against desertification is won or lost at the local level. At the same time, the Convention recognizes explicitly that local action requires an enabling environment (facilitating legislation, long-term policies and action) at higher (national and international) levels (Krugmann 1994).

The Convention also recognizes that effective local action will not be possible unless local rural people and communities:

- have greater control and responsibility over their local resources;
- are able to command a greater range and level of resources (to be more "resourceful"); and
- are able to participate in and influence higher-level decision-making processes by which they are affected.

Throughout the Convention text, explicit statements about the importance of poverty reduction and the need for local participation in all desertification control activities are found. The essential elements of the enabling environment are also obtained in the Convention.

At the *national* and *subnational* (provincial, district, location, sublocation, etc.) levels, this includes:

1. More democratic (participatory) and decentralized political and administrative structures — Their purpose should be to devolve authority over natural resource management to government levels that are as close as possible to those (local) people who directly depend on the natural resources for their livelihood.

2. Appropriate land and resource tenure and ownership systems and policies — These should reflect the existing sociocultural diversity across local settings, allow statutory laws to build on (rather than undermine) existing local customary rules, and provide security in resource tenure for local land users, who can then reinvest profits locally and, in particular, make long-term investments in land improvement.

3. Appropriate economic policies, structural adjustment approaches, marketing structures, and trade patterns and mechanisms — These should improve terms of trade for local livestock keepers and farmers vis-à-vis larger-scale markets, and allow local livestock keepers and farmers to retain a greater proportion of the marketing margin for local (re)investment, including land resource conservation measures.

4. Encouragement of local capacity for self-help and, beyond that, provision of technical and financial support to build the capacity of representative and participatory local community institutions.

5. Adaptation of education systems and curricula to give greater weight to traditional local knowledge and discovery of ways to combine it with modern scientific knowledge in natural resource use and management.

At the *international* level, the enabling environment includes aspects such as:

1. Enabling world trade patterns — To allow access to Northern markets, facilitate diversification of the domestic economic base, and complement development assistance objectives (rather than undermine them).

2. Gradual reduction in foreign debt obligations, linked, if possible, to progress in creating national enabling environments for more sustainable local resource use and livelihood.

3. Appropriate global agreements (like the Desertification Convention itself) to harmonize international environmental, economic and other policies and to coordinate national actions that have global impacts.

Having summarized the framework for action under the Convention, let us now turn to the role of indicators in measuring and monitoring desertification processes as well as the implementation of action programs.

The Convention document lists indicators related to the collection, analysis and exchange of relevant data and information for the systematic observation of land

degradation in affected areas.[9] More specifically it mentions the development of "integrated sets of physical, biological, social and economic indicators." In the Regional Implementation Annex for Africa there is also a call for the establishment of "pertinent, quantifiable and readily verifiable indicators to ensure the assessment and evaluation of national action programs, which encompass actions in the short, medium and long terms, and of the implementation of such programs."[10]

Article 26 of the Desertification Convention, on the communication of information, requires affected Parties to the Convention to report periodically on measures and strategies used to implement the Convention, and specifically on national action programs and their implementation. It is left to the Conference of the Parties to determine the format of such periodic reports. Yet it is fair to say that desertification indicators will likely be central to whatever reporting format is agreed upon. The time up to the ratification of the Convention (perhaps in 1997) and until the first meeting of the Conference of the Parties should therefore be used to examine, test, and begin to experiment with different indicators in order to come to a better understanding of what sets of indicators would be most appropriate.

The Convention text clearly establishes the need to look for multidisciplinary and integrated sets of indicators. The importance of different time horizons for indicators (and their sensitivity to change over time) is acknowledged implicitly: actions are to be taken in different time frames and this will require the identification of different indicators through which the effects of these actions can be monitored.

Beyond that, additional qualities of indicators can be inferred from the framework for action underlying the Convention, as outlined above. Perhaps most importantly, close attention to local level environmental change and action in combating desertification, the importance of tapping relevant local knowledge, and the need to rely on both local and scientific knowledge, and bring the two together — aspects that are all spelled out in the Convention — call for the local

[9] Article 16, paragraph c) of the Convention.

[10] Article 9, paragraph d) of the Convention.

application of indicators that are generated either locally (i.e., grassroots indicators) or externally (likely scientific indicators).[11] Some combination of the two, or what I refer to below as "hybrid indicators," may also be possible. Nevertheless, it is grassroots indicators based on local environmental change that have usually been neglected or entirely ignored in developing indicator sets and designing monitoring and reporting systems.

Grassroots Indicators and "Hybrid" Indicators

In this section, I characterize attributes and qualities of hybrid indicator systems by using examples from the Rombo Location, Kajiado District, which is located in the southeast corner of Kenya's Maasailand. I will also touch upon the issue of how such systems might be made operational when there are tight constraints in terms of practicality, cost, and rapid implementation.

General Characteristics of Desertification Indicators

Several characteristics of relevant desertification indicators can be delineated. First, they tend to occur in a hierarchy or cascading series of levels including micro-, meso-, and macroindicators. These levels reflect perspectives, experiences, processes, and actions at different levels. For example, government officials at different levels (national, provincial, district, location, etc.) may be making decisions that affect local desertification processes or the implementation of local projects intended to combat desertification. Or, price changes of livestock products or agricultural produce in national markets may influence farm gate prices and hence levels of cash or family labor surplus, some of which could be invested into land conservation measures.

Indicators are also dynamic, signaling and reflecting change in variables over a certain period of time. For example, changing tree or grass cover or changing tree or grass species composition in a given area over a period of a decade may reflect or signal processes of resource degradation due to competing land uses such as transhumant pastoralism and rain-fed or irrigated agriculture. Or, rising numbers of landless people could be an indicator of land privatization in drylands some

[11] The distinction between "local" and "external" in the generation and use of knowledge is taken from Anil Gupta's "Generation of Knowledge" matrix (Appendix, Table A2).

years back. An interesting example of an indicator whose dynamic quality leads to conclusions that are quite different from those derived from a more static picture is the landlord-to-tenant ratio in irrigated agriculture identified in the Rombo area. This ratio is presently about 20:80 (irrigated), which signals environmental sustainability problems, since short-term tenants normally have no interest in land conservation investments yielding long-term returns. Nor do Maasai landlords encourage such investments on the part of tenants, as they do not want the tenants to become so permanently installed as to eventually claim rights to the land. It is interesting to note, however, that the landlord-to-tenant ratio has been rising over the past 10 years — at least for irrigated agriculture in the Rombo area — from 5:95 in 1984 to 20:80 in 1994, indicating rising interest among the Maasai to practise irrigated farming themselves. This trend appears to augur well for the sustainability of irrigated farming in the area. It also indicates great cultural change among the Maasai who, traditionally, have been nomadic pastoralists reluctant to get involved in agriculture.

It should also be recognized that indicators are specific to given ecological, cultural, social or economic contexts, or to gender or age class. For example, tree flowering just before the rains come: while the phenomenon may occur in many different locations, the particular trees in flower may be specific to a particular area. The average number of wives a man has is culturally specific. In Maasai society, this number seems to have gone down, hand in hand with complex socio-economic changes involving the penetration of the market economy, diversification of the livestock economy into agriculture and other investments, education, conversion to Christian beliefs, and many other factors. This may be an indicator on the degree to which traditional social organization based on principles of solidarity and sharing has been changing, with far-reaching consequences for the degree of sustainability of land use. Along similar lines, the decreasing average number of families living in residential units or *manyattas* indicates increasing social fragmentation.

Indicators can be both quantitative and qualitative. Quantitative indicators (such as market prices for, or yield of, agricultural produce) are easier to measure and aggregate. On the other hand, qualitative indicators (such as the new phenomenon of Maasai men going to the butcher to buy meat) are often better able to capture the complexity of changing situations.

Indicators may be considered "direct" or "indirect," although this can be a false dichotomy. There is a wide range in the degree to which variables of a system signal a process of land degradation, or indicate the effects of action taken to control desertification more or less directly. For example, the appearance of gullies is a direct indicator of soil erosion, and hence land degradation. The decreasing price of charcoal in the Rombo area is a somewhat more indirect reflection of increasing environmental degradation: increasing rates of land clearing for agriculture on the group ranch increase the wood supply for charcoal making, which in turn puts downward pressure on the charcoal price (on the informal market, as charcoal making is illegal). An even more indirect measure of land degradation (or its potential) may be the rising average landlord-to-tenant ratio in irrigated agriculture noted above.

The selection of indicators naturally will depend on the purpose for which they are to be used. In connection with desertification assessment and the monitoring of the implementation of the Desertification Convention, environmental indicators may be broadly categorized as either descriptive or performance-oriented (World Bank 1994). Descriptive indicators illustrate the status of the environment, or the process of environmental change over time. Most, if not all, of the examples of indicators mentioned so far in this paper fall into this category. In general, measuring and monitoring of desertification processes will involve the use of descriptive indicators. Performance indicators, on the other hand, are measured against some benchmark, physical threshold or normative policy goal that may be related to sustainability. Such indicators become important in the context of the implementation of national action plans (NAPs), and local programs and projects that may be undertaken to fight desertification. Clear definition of policy objectives for factors like resource use efficiency, tenure security, emission levels, or equality in resource use and access, will be necessary to construct performance indicators to measure progress towards the specified target.

To use the example of landlords and tenants in the Rombo area, suppose a project were formulated providing incentives for landlords to farm themselves, rather than leasing land out to tenants. A target of 100 percent landlord-farmers could be set as a goal, and the landlord-to-tenant ratio, which previously characterized the land-tenure dimension of the process of environmental degradation, could be turned into a performance indicator measuring the effects of the project.

Indicators as Parts of National and Local Reporting Systems

National reporting under the Desertification Convention will likely be a matter of considerable experimentation and debate on the kinds of indicator and monitoring systems best suited for the purpose. One could think of a hybrid indicators system consisting of a (minimum) set of descriptive indicators covering all the drylands in the country on the one hand, and of special sets of performance-oriented local indicators to monitor the impacts of particular antidesertification projects on the other.

The general (minimum) set of indicators would be monitored continuously and would reflect the cascading series of policy action levels that are contributing to the enabling environment, from the international and national level down to the local. At subnational levels, this set of indicators could cover the full extent of drylands in a country, depending on availability of resources. There would be opportunities for including grassroots indicators and involving local communities in monitoring at the local level.

Locally specified sets of indicators for particular local initiatives would be designed according to the nature and purpose of the initiatives. Monitoring of these special local sets would begin at the start of the projects and continue as long as necessary to observe their impact. Since projects would be designed and implemented in a participatory fashion, there would be ample opportunity for community participation in selecting and monitoring indicators, including grassroots indicators.

For obvious reasons, it is important to select indicators that are easy and inexpensive to measure or monitor. A viable system of national reporting to the Conference of the Parties of the Desertification Convention, once ratified, will require minimizing the degree of effort and expense involved in monitoring desertification processes or the effects of antidesertification programs. Available financial resources are always limited: the Desertification Convention is certainly no exception. It is also important to keep an appropriate balance between the costs and efforts of monitoring vis-à-vis the costs and efforts invested in the

implementation itself.[12] Too much monitoring of action and its effects at the expense of action itself may be counterproductive. It is best to choose simple indicators that are easily measured or monitored, and can be used in different local situations with little effort of adaptation. Care should be taken, however, not to fall into the trap of using faulty or irrelevant indicators in the name of economizing or available resources. For example, the market price of a good or service (environmental or otherwise) may be easy to monitor, but market failure and other effects may obscure what exactly the price indicates or reflects. The price of charcoal in the Rombo area, for example, certainly does not internalize environmental costs. Quite the opposite: the faster land is cleared, the lower the price.

In this connection, grassroots indicators, or locally adapted scientific or "hybrid" indicators, present advantages. They can be monitored by local communities. Drawing on numerous local eyes and ears will reduce the cost of monitoring the implementation of the Desertification Convention to governments. Such decentralization of monitoring activity is also consistent with the principle of maximum local participation in all efforts of desertification control.

Classification of Land Degradation Indicators from Rombo Location

In this section, some of the desertification-related indicators which might be considered at the local level in a place like Rombo are discussed. The actual classification system is presented in Table 3. Most, or all, of the listed indicators emerged from in-depth discussions with a variety of local resource users — pastoralists, cultivators of rain-fed and irrigated land, landlords and tenants, traders of livestock or agricultural produce, small-scale businessmen, and combinations thereof. But before listing the indicators, a brief description of Rombo Location and a summary of the major factors facilitating desertification is in order.

[12] The monitoring of elephant movements in East Africa is an example of a perceived imbalance between monitoring and implementation efforts. It has been charged that far greater resources were used to monitor elephants than to do something to improve the prospects of elephant conservation or sustainable utilization.

Table 3. Classfication of Indicators from Rombo Location, Kajiado District, Kenya

General	Specific	Examples
Ecological indicators	Reduction in, or disappearance of, particular tree species	Olmokatan tree — The bark is used as a catalyst for local brewing, as a traditional medicine for stomach problems (wormicide) "to clean the system", and as an appetizer.
		Olorien tree — The trunk is used to make charcoal pieces to clean calabashes (rubbing of inside surface). Charcoal residues also serve to preserve milk.
		Oiti tree — A hard wood to make sticks for walking and building purposes.
		Orkonil tree — The roots are used by the Maasai in soup and tea making, as an appetizer, and a kidney cleaner.
		Oliloriti tree — The bark is boiled to make a beverage (milk and sugar added), the hardwood is used for sticks, etc; and, it is also used as an herbal medicine against stomach problems.
		Osokonoi tree — The bark is used as a medicine to cure stomach problems, also for chest pain and sore throat (tonsils).
	Reduction or disappearance of (nutritious) grass species	Entimonyoa grass Erikaru grass
	Flowering of tree a few days before the rains come	Oiti tree Olmokotan tree
	Tree leaves change colour just before the rains arrive	Leaves of Olmomonyi tree turn dark
	Appearance spreading of gullies	
	Formation of "wicked winds"	Visible vertical vortices or small tornadoes through the sucking up of dust

(continued)

Table 3. *(continued)*

General	Specific	Examples
Climatic indicators	Cloud formations indicate impending rains	
	Elders look at stars to predict rains	
	Reduction in average rainfall	
	Variability in rainfall	
	Variability in beginning or end of rainy season	
	Prolonged absence of rainfall (drought)	
Land use indicators	Elephants "harvest" maize	
	No water for livestock downstream from irrigation schemes	
Economic indicators	Price indicators: relative prices in marketing chain (e.g., farmgate vs. wholesale)	Local prices of crops, livestock; terms of trade between the two or between rural and urban dwellers; prices of water, charcoal.
	Income indicators (difficult?)	
	Wealth and asset indicators: e.g. cattle holdings per family	
	Time or money spent by families on fetching firewood and water	
	Indicators of economic diversification	Number of people practicing agriculture or livestock management.
	Where are profits (re) invested?	
	Government support and extension services	

(continued)

Table 3. *(concluded)*

General	Specific	Examples
Social indicators	Number of families per homestead (residential unit)	
	Inequality indicators (distribution of income and assets per family)	
	Number of wives per family	
	Form of bride wealth (cows, money)	
	What proportion of children go to school?	Proportion of children that looks after cows.
	Livestock transfers and associateships	Who bears the risks — giver or receiver?
	Changing gender roles	
Institutional indicators	Resource tenure indicators: landlord-to-tenant ratio	Status of land subdivision Access to water
	Existence of cooperatives or local interest groups	
Cultural indicators	Proportion of Maasai who cultivate	
	Maasai going to the butcher to buy meat	
	Who selects wives?	
	Changing proportion of ethnic groups in the area	
Political indicators	Local power relationships	
	Local effects of multiparty politics (e.g., land sub-division necessary for political reasons)	

Rombo Location is situated in the southeastern corner of the Loitokitok Division of Kajiado District, in the immediate vicinity of the Tanzanian border and Mt. Kilimanjaro. The area is part of Kenyan Maasailand. My field work covered only two sublocations of Rombo Location, namely the Rombo and Njukini Sublocations. This area comprises the Rombo Group Ranch, held under group title, as well as farmed land (rain-fed or irrigated) held under individual private title. The group ranch and the individual ranches of plots were created in the late 1960s to early 1970s, when Maasailand was adjudicated. The Rombo Group Ranch has an area of 38 365 hectares of mostly semi-arid land and a population in the range of 20 000 to 25 000 (3 398 registered members).

There are a number of trends and issues which contribute to land degradation in the area. First, there is a growing encapsulation of the extensive livestock economy that used to be the sole basis of livelihood for Maasai nomadic pastoralism. Over the past few decades, critical dry-season grazing areas — highlands and mountain slopes around Mt. Kilimanjaro, elevated higher-rainfall areas to the East, and a variety of water springs in the lower lands fed by Mt. Kilimanjaro — have been removed from the extensive livestock economy, as a result of land adjudication (privatization), rain-fed and irrigated (sedentary) cultivation on the individual private ranches and plots that were created, and the establishment of the Tsavo and Amboseli National Parks. Access to grazing resources and water sources, especially in the dry season, and lack of sufficient herd mobility due to spreading agriculture (even on the group ranch) and population growth, have become serious problems. The livestock economy seems to be fast losing its viability as the sole basis of livelihood for the Maasai. Increasing diversification into agriculture (primarily maize, beans and irrigated horticulture) and other investments can be observed among the Maasai.

One also finds significant resource conflicts between agriculture, livestock and wildlife that have to do with available land, grazing, and water resources in this region. These conflicts arise from the expansion of agriculture on the group ranch, livestock crossing into Tsavo National Park to graze during the dry season, and wildlife entering the group ranch and private farms to feed on livestock and "harvest," or destroy, agricultural fields and trees, primarily in the dry season. There are also significant conflicts among irrigators within and across irrigation canals.

A third cause of land degradation has been the widespread custom among Maasai land owners not to farm themselves but to lease out their agricultural land to tenants — either Wachagga from across the border or members of Kenyan ethnic groups, primarily Kikuyu and Kamba. As a consequence, there are many more tenants than landlords farming in the area, cultivating the land on the basis of short-term (one year) informal lease arrangements. Short-term perspectives and lack of land conservation are fueled by both the landlords, who often fear claims by (Kenyan) tenants to land they have farmed for some time, and by the tenants, who "mine" the land for lack of incentives to invest in longer-term land improvement. Also, the tenants' profits from agriculture are not reinvested locally, but tend to flow out of the area.

Rain-fed and irrigation cultivators are exploited by outside brokers and middlemen, and this has unsustainable implications for the natural resource base. The local road, transport and communication infrastructure is very bad and the prime reason for the ongoing exploitation. The proportion of the marketing margin that is appropriated locally is small (farmgate prices are much lower than the wholesale or retail prices in Mombasa or Nairobi). To date, the lack of local institutional cohesion (see below) has thwarted attempts to form local farming cooperatives and other pressure groups to break the stranglehold of outside brokers and exporters of horticultural produce.

The group ranch had decided to subdivide, giving each registered member (and some of his sons) a share. The experience in other parts of Kajiado Districts shows that subdivision leads to the selling of shares (and landlessness) among those poorer members of the group ranch who end up with a dry nonviable piece of land or default on bank loans for which the piece of land has been used as a collateral. Such occurrences partly account for the strong social stratification and institutional fragmentation in the area. This is also a result of the following factors: competing land uses; the existing cultural diversity and differences of an ethnic mix of indigenous Maasai on the one hand and nearly as many immigrants from other parts of Kenya on the other; the daily and longer-term influx of Tanzanian tenant farmers; and a penchant for politics among the local elite. This situation has made reaching a consensus and organizing community action to address major issues facing the local population difficult.

Finally, population growth may be diminishing in Kenya overall, but is still strong in this region. The Maasai have very large families: 4-5 wives and 20-30 children in total are not rare. The combination of all these factors and others which may appear as research continues, underlie land degradation and desertification processes in the location.

As Table 3 suggests, a classification of possible local indicators of land degradation, as derived from discussions with local people in the Rombo area, can be divided into categories including: ecological, climatic, land-use, economic, social, institutional, cultural, and political. In conclusion, let me stress that this table and its examples should be considered a "work in progress," as at the time of writing, this research project was still underway.

Conclusion

This paper has attempted to illuminate the characteristics of desertification indicators and the need for improved, and possibly combined, "hybrid" indicator systems through examples from research undertaken in Rombo Location, Kenya.

It is apparent that improved indicators (including grassroots indicators) cannot provide all the answers either. Just as the implementation of the national desertification action programs requires actions and mechanisms at higher levels (an enabling environment), so will it be necessary and useful to identify and construct indicators that reflect higher-level perspectives and experiences. The hierarchy of levels of policy and legislative action may, therefore, correspond to a cascading series of indicators. The real challenge will be to evolve hybrid indicator systems bringing together the different relevant perspectives and knowledge systems — local and (sub)national, "bottom up" and "top down," traditional and scientific — to name just some of the many possibly opposed, but potentially complementary, sets of indicators.

Grassroots Indicators and Scientific Indicators: Their Role in Decentralized Planning in the Arid Lands of Uganda

Patrick Orone

Introduction

Desertification is defined as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities." As Evers (1994) points out, the current debate on desertification has tended to focus on alarming data and trends in climatology and ecological change, to the neglect of the influence of, and impact on, social conditions.

Two main global data sets have been used to provide indicators of desertification worldwide. The first is the Global Assessment of Soil Degradation (GLASOD) model. These data estimate the incidence and severity of soil degradation by continent, on the basis of their interpretation by scientists and technicians. The second data set for measuring desertification in dryland areas combines GLASOD data with information from the International Centre for Arid and Semi-Arid Land Studies (ICASALS). This framework covers soil and vegetation degradation as well as changes in the composition and level of vegetative cover.

The two data sets above obviously give very different pictures of the extent of world desertification. Moreover, the accuracy, meaning, and practical usefulness of these estimates of global desertification trends are increasingly questioned, particularly given the difficulty of determining the causal relationships of such complex processes (Toulmin 1993).

In response to the unsatisfactory measures involved in macro-level surveys, there is a strong move towards studies of desertification as environmental change, focused on experience at the local level (Toulmin 1993). Such studies have tended to demonstrate the resilience of physical conditions and associated pastoral and farming systems in the face of substantial climatic variability. As well, from this point of view, desertification and environmental degradation are seen both as causes and consequences of unequal development and poverty arising out of the integration of smaller social systems into a worldwide economic system controlled by the developed nations.

Coping with Change: Grassroots Indicators

Local people, in response to the inequalities of development and continuing poverty, develop approaches to cope with negative situations. These coping mechanisms can include swamp reclamation, and cutting trees — either to make charcoal or produce firewood for sale. To the local people, these actions are *not* seen as degrading the environment or causing desertification. Instead, the sources of degradation are desertification and poverty.

Several reasons can be advanced to explain the local perception. The most important of these, however, have to do with differences in the way local people and outsiders (intellectuals) conceptualize issues like desertification. Clearly, the "cause and effect" reasoning which has been characteristic of antidesertification studies, policy and programs is at odds with the reality at the "grassroots." This understanding also differs because the intellectual (scientist) has an understanding and conceptualization of macro-level, global issues, while the local person has an understanding based on issues limited to the local surroundings, and over prolonged periods of time.

On the basis of research among the Teso community in semi-arid Northeastern Uganda it is possible to elaborate an example of the grassroots indicators (Table 4). The oral traditional calendar of nine "months" provides a framework for grassroots indicators among the Teso of Northeastern Uganda. The "months" or seasons are signaled by indicators of environmental change and determine a set of appropriate actions (in this case, agricultural activities). This calendar, as a set of "grassroots indicators," also demonstrates how local people are aware of changes over time and the need for changes in their activities.

According to the local knowledge of the Teso, unpredictable rains and long periods without rains may result in increased cultivation of swamp land. For example, the Teso are increasingly shifting the location of the fields where they plant crops like sweet potatoes, following swamp areas that remain relatively wet. A lack of, or inadequate, crops to sell for cash has resulted in the introduction and increased cultivation of paddy rice within swamps. These activities appear, to the scientist, to contribute to swamp land degradation. In addition, lower household cash incomes, earned mainly from some food items, have led to other means of obtaining cash income, including charcoal production and firewood for sale, and

increased sale of other assets, like land. To the intellectual, this means increasing landlessness. Thus, desertification has caused shifts in the local economy and society which have led to "innovative" approaches or survival strategies by local people that, from the scientific point of view are having negative impacts on the state of the environment — that is, contributing to desertification.

The two different approaches to understanding environmental change suggest differences in indicators. Scientists' explanations are derived from conclusions based on macroglobal data sets, and perhaps even local-level studies of degradation and not innovation. Local perceptions and knowledge are derived from the experience of observable change over time. These serve as the basis for a "grassroots indicator." Other papers in this book will address the examples of indicators in detail, but there is a need to examine the relationship between scientific and grassroots indicators. Specifically, what is the relevance of these indicators to development planning which will directly impact desertification processes and land degradation at the local level?

Scientific Indicators

In the pursuit of monitoring the effect of the interactions between people and the ecosystem, and to bring about adequate nutrition, meaningful employment, and a more equitable distribution of income, science and development have relied heavily on development indicators. Gross national product (GNP) and GNP per capita have been the most established measures of "development." The GNP is incorporated into more sophisticated frameworks, such as the Chenery-Ahluwulia Index and Todaro's Index. With time, however, such economic indicators, including their methodology and analytical procedures, have come under criticism. Inclusion of social statistics in economic modeling was perceived as a more appropriate approach to identifying and utilizing development indicators.

Table 4. Grassroots Indicators Based on the Oral Traditional Calendar of the Teso of Northeastern Uganda

Traditional name of month	Modern name of month	Grassroots indicator	Expected agricultural activity
Orara	January	*Mvule* (*Chlorophora excelsa*) leaves shed *Etekwa* sheds flowers The Six Group of Stars appears directly overhead	Completing second land preparations Most people have planted their millet by now
Omuku	February	Cattle excited Rains start *Engiirit* disappears underground Winds blow from west to east	Millet starts to germinate
Okwang	March	Flowering of crops and grass *Sasa-koru* bird sings Children suffer from cough and diarrhoea	Weeding millet
Odunge-Opedelei	April - May	"Children stand on the doorway to kitchens" Famine starts	Millet begins to develop heads Scooping of *egori* from the river and lake beds for food
Omaruk	June	Dry period Winds blow from east to west Famine should end Children malnourished	Picking mushrooms in the forests Millet almost ready
Omodokoki-Ngoli Otikoik	July - August	Cattle excited Rains start "Cooking stick is left with food coated on it" Food is available Winds blow from west to east	Harvesting of millet Planting of cotton
Otibar-Osokosok	September-October	Dew increases Rains People wake early and move greater distances	Debt recovery Crop sales (only cotton)
Osuban	November	Many ceremonies and visiting among kin and neighbours	Festivities
Opoo	December	*Tulente* bird appears Strong winds start to blow from east to west *Mvule* tree starts to shed its leaves Children become ill with measles	Start of land preparations Burning of grass

However, social statistics still play only a minor role in development monitoring and measurement, particularly at the level of national planning. Although there had been considerable improvements in the collection and analysis of macro-microeconomic and demographic statistics, integration with social statistics remains unsatisfactory. According to Scott (1978, p. 20), "...there is yet no equivalent data source that takes into account more recent approaches to planning, directed towards an integrated social and economic process rather than a micro-economic modeling with social by-products."

The above criticism had led to new thinking that argued for a more detailed description of the development process than is provided by GNP. According to this view, if development is concerned with raising the living standards of the population, pertinent information should be furnished showing whether their key social conditions and related services are improving or deteriorating over time. Over the past two decades, social scientists, statisticians, and policymakers have continued to address the need for a new set of statistics which satisfies these requirements. As noted by Drewnowski (1976, p. 12),

> As long as we express the results of development in terms of monetary values of goods and services, we take an economic viewpoint. We consider the resources provided but not how they affect peoples' lives. As the aim of all economic activity is to improve the conditions in which people live, this means we have stopped half-way in assessing the consequences of development. To obtain a complete picture of development it is not sufficient to realize the amount of resources brought about by economic growth. It is necessary to examine the impact of these resources on the life of the people.

Few African nations have reliable statistics for meeting the requirements of a system of social indicators. Assuming that agreement on the definition of a selection of key social indicators is reached, there is still some difficulty in obtaining temporally and spatially comprehensive statistical series. Although data collection and information management have improved remarkably in many African countries recently, other types of data, and more importantly, their relationship to environmental change and issues such as desertification, are largely inadequate.

There is a second problem area related to the development of improved scientific indicators in African countries: they lack coordinated data systems with common

concepts, classification systems, and methodologies. Both macroeconomic and social indicators are derived from data extracted by means of questionnaire tools, for use in essentially top-down development planning processes. Macro indicators have resulted in considerable dissatisfaction as tools to assess progress towards sustainable development. These top-down planning tools fail to effectively capture sustainability in development, which is increasingly being associated with "bottom-up" planning.

Decentralized Planning in Uganda

The late 1980s saw development planning begin to change direction towards a policy of decentralizing "development." This shift obviously requires some re-formulation of development indicators and is very much evident in Africa. For example, there have been strong moves towards decentralizing development in Uganda. Democratization and decentralization in the country started in 1986, with the establishment of the now familiar resistance councils and committees (RCs). Since then, the Ugandan government has been evolving towards a system which aims at improving local democracy, accountability, efficiency, equity and sustainability in the provision of social services and environment.

The RC institutions have been conceptualized by the government as instruments of participatory democracy in which people are directly involved in the governing of their own communities and making decisions that affect their daily lives and environment. Relevant to this paper, the functions of the RCs as policy-making organs within their areas of jurisdiction are:

- identifying local problems and solving them;
- formulating and receiving development plans.

Development planning will therefore integrate the diverse district plans into the national development plans by means of a "bottom-up" approach. In each district in Uganda, therefore, there will be a smaller district development committee (DDC), comprising members of the district resistance committee (DRC) and one

councilor from each county.[13] A Planning Committee will consolidate and elaborate the social development plans and draw up plans for consideration and approval by the DDC.

This decentralization process represents a major change in the structure of the development planning system in Uganda. More responsibility and initiative in planning will be conferred on the local authorities, in line with the general policy of strengthening local responsibility and transferring central government control. In the long run, this shift should make for better, and more effective, planning at the local level and more public participation. But will this be all the right way forward? Several researchers have noted that the importance of popular participation is widely acknowledged and advocated, but there is a gap between rhetoric and reality.

We note that in Uganda, there will still be a remarkable gap between the local people as participants in the "bottom-up" planning process on one hand, and the professionals at the district or national level, on the other. In particular, planning by the former is based on local knowledge acquired through long experience and observation and orally passed from one generation to the next. For established development planners, it is based on scientific and statistical knowledge acquired through formal education and procedures based on the western planning paradigm. This is the same western paradigm which in many instances has failed to solve the problems of inequitable, unsustainable distribution and use of national and local resources.

The focus of the current rhetoric in decentralized "bottom-up" planning and participation by the local people, is really to "decentralize top-down planning" to the local (districts) level, and probably bring the planning process nearer to the people, rather than involving them. If this approach is followed without further examination, how will communities be brought into the development process? Furthermore, the problems of the lack of coordinated indicators and a comprehensive system of common concepts, classifications, and methodologies for monitoring development and the environment will not be solved.

[13] The DDC also will have a Technical Planning Committee consisting of the District Executive Secretary (DES) as Chairman, the District Population Officer (DPO), the District Statistician (DS), the District Economist (DE) as Secretary, the District Physical Planner (DPP), the District Agricultural Coordinating Officer (DACO), and the District Education Officer (DEO).

Conclusion: A Call for an Indicator Merger

Despite the current move towards a decentralized approach to development planning based on "bottom-up" planning at the district levels, development plans based on conventional scientific indicators alone will fail to reflect the social, cultural, economic, and political realities at the local level. This dilemma is particularly evident for issues like desertification: for the local people hold a view of their environment and its desertification that is radically different from the one held by the scientists and development planners.

Popular participation in decentralized, "bottom-up" planning will only come closer to reality when the tools of planning are controlled at the grassroots level. This requires combining "grassroots indicators" with scientific indicators and applying them within a decentralized participatory planning process.

This page intentionally left blank

PART 2

METHODS AND APPROACHES

- The Importance of Cosmology
  Dan Lubowa

- Language and Grassroots Environment Indicators
  Frederick Mwesigye

- Research Methodologies for Identifying and Validating Grassroots Indicators
  Lemeck Kinyunyu and Marja-Liisa Swantz

- Identification of Land Degradation Levels at the Grassroots
  Matthijs de Vreede

This page intentionally left blank

The Importance of Cosmology

Dan Lubowa

Introduction

After almost a half a century of conservation activities in the arid, semi-arid and drought-prone lands of Africa, we are no closer to finding solutions to the pressing problem of desertification. This failure can be attributed to inappropriate technology, incomplete research, and a lack of effective management. Consequently, researchers in the forefront of desertification control have proposed a closer linkage between traditional land-use management systems and modern scientific knowledge and technology.

This paper is based on a study of precolonial Kingdom of Buganda society, whose descendants live in present-day Uganda. This region of southern Uganda bordering Lake Victoria has begun to face extensive degradation of its natural resources. This study of the cosmology or belief system of the ancient people of Buganda has a broader relevance to how people understand environmental change and conservation, including modern eremology, or the study of drylands.

Background

This study involved interviewing elders and cultural experts, and examining archival work on the subject of environmental change. Its aim was to assess the relevance of Kiganda cosmology for understanding specific environmental problems. To do so, a number of assumptions were made. First, it was necessary to assume that an overall cosmology was constructed by the Baganda people in their active engagement in the generation, acquisition and classification of knowledge within their cultural, economic, agroecological, and sociological context, as well as a result of internal and external interactions. This cultural knowledge produced and reproduced mutual understanding among the Baganda. Technical land-use knowledge, skills, and capacities were, therefore, inextricably linked to nontechnical cultural, ecological, and sociological factors.

Second, we assumed that the Kiganda belief system and Western science represent different and contrasting epistemologies produced by particular agroecological,

sociocultural, political and economic settings. Finally, the Baganda had a pantheistic outlook of continuity and an attitude of submission to nature, contrary to the western Judeo-Christian ethic of dominating nature.

Because desertification results from continuous degradation caused by poor land use, there is a justified need for a sustainable livelihood. Living sustainably depends on accepting the duty to seek harmony with other people and with nature. People must share with each other and care for their environments. Equally, humanity must take no more from nature than nature can replenish. The livelihoods of the ancient Baganda, guided by their cosmology, respected and worked within nature's limits. The following sections of the paper expand on the basic principles of Kiganda life, which aimed to maintain a sustainable livelihood. The principles are interrelated and mutually supportive. The discussion starts with the ethical founding principles of the culture, indicating the degree to which sustainable livelihood should be measured.

Respect for the Sanctity of Life

This first cosmological principle among the Baganda reflects the duty to care for other people and other forms of life, now and in the future. This was the fundamental principle of the Buganda culture: it provided the ethical basis for other principles. The Baganda aimed at fair sharing of the benefits and costs of resource use, and environmental conservation among different communities and interest groups, including both rich and poor, and between their generation and those who would come after them. They believed that life is part of one great interdependent system, which influences and depends on the various components of the Earth, including the geological and atmospheric systems. It was known that by disturbing one biospherical part other parts would also be affected. The Baganda, therefore, managed their lifestyle so as not to threaten the survival of other species or eliminate future inhabitants.

Despite the fact that the survival of the Baganda depended on the use of other species, their belief system did not allow cruel or wasteful use. For instance, before cutting the *mvule* tree (*Chlorophora excelsa*) for ship building, the builder had to use the ancestral axe called *Nankago* to make the first cut while saying: "*Muvule gwe sikwewadde nzekka, wabula Nankago yakwewadde*," that is, *Nankago*

the mediator has given itself the tree and not the one cutting it. The Baganda did not believe in wasteful cutting down of trees or misuse of other resources because they all had a right to life.

Conservation of the Earth's Vitality and Diversity

In the day-to-day activities of the Baganda, there was always deliberate action to protect the structure, functions, and diversity of the natural systems on which species depend. In their view of nature's conservation of life-support systems, climate was shaped, air and water cleansed, water flow generated, essential elements recycled, and soil created and regenerated. Consequently, ecosystems renewed their services, and in so doing, the biodiversity of Buganda could be conserved for plants and animals.

The following sites, believed to belong to Bugandian gods, were highly respected and therefore protected and left undisturbed. They were Bbowa, Ssenga, Walusimbi, Kateeranduulu, Kigo and Busuwa in Bulemeezi County. These places were also universally accepted as life-saving sanctuaries. Whenever the Kabaka (King) would attack the people, they would run and hide at these sites because it was strictly prohibited for the King or any other person to attack any one there. And when the people found out about an impending attack by the king, they would run to these sites. There were other sanctuaries too: In Singo County, the Mubende, Majala and Kagaba hills, and the Buloda and Bwanjo forests, where the royal drum tree was harvested. In Mawokota County, there were the Saabwe and Kungu hills, and the Kisitu and Mpanga forests. In Busiro, there were the Bakka hills, while in Kyagwe, there was the Wagula hill and Buvuma forests. Indeed, everywhere in the kingdom there were many life-saving sacred places.

In addition, there was always a deliberate and mandatory renewable and sustainable use of all resources. The Baganda had control over the use of wild plants and animals, forests, and measures to ensure sustainable fishing, forestry, rangeland use, and cultivation. In Buganda, this was done by *Ddungu*, the god of wild animals, in whom power to regulate hunting was vested. All hunting had to be done after consultation with him and with his permission. He strictly prohibited killing young and pregnant animals. Moreover, since the hunters believed that they were at one with nature, whenever they killed an animal they

could not bring the head home for fear of being haunted by the spirit. After every successful hunt, they also had to appease the gods to ensure that the wild animals continued to reproduce.

Observing the Carrying Capacity

In modern times, it has been believed that the biggest threat to the Earth's carrying capacity is rapid and uncontrolled population increase. Among the Baganda, population was controlled by frequent periods of strict sexual abstinence. Wherever there was a function or task to perform there was a period of abstinence for both ruler and ordinary people. For instance, fishermen had to make three successful catches in order to sleep with their wives.

The second threat to the environment's carrying capacity is the promotion of unequal access to natural resources, which was discouraged in Buganda. The principle of generosity and justice ensured that natural resources were equitably used by the people. For instance, whenever fishermen shared their fish, they had to ensure that no one was favoured, because favoritism would mean failure in the following fishing sessions or problems in the lake.

Minimum Depletion of Nonrenewable Resources

Minerals like iron and copper, and commodities such as clay, are not renewable like the plants, fish, game, and soil, and cannot be used sustainably. The Baganda, therefore, had various means of extending the availability of these resources. These included recycling, using less of the resource to make particular products, and reducing wasteful destruction of such products.

Clay was controlled by a strict code of periodic extraction. For example, clay could not be mined during a new moon because it would have *amasumi*, so that if it were made into pots, they would not last. In addition, it was mandatory for potters to reuse old pot materials, or *enseeso*, which were mixed with the new to reduce the amount of fresh clay used in making their products. Their conservation was effective: Buganda clay is still available today. It was clearly a valuable material in ancient Buganda. No one was ever allowed to break a clay product

— not after a quarrel, not even during war. When a village was attacked, they would kill all the people, but not touch the clay pots. They could carry them away, but not destroy them.

Indigenous Forms of Education

Ancient Bagandian cosmology promoted values that supported conservation and discouraged values and ethics incompatible with sustainable ways of life. This information was imparted through strict instruction of the young by the old, and through proverbs, sayings, and songs intended to teach conservation. For example, the Baganda people had proverbs with double meanings, like the saying, "*Omubiiri Mutuuba bwotogusombera togufuna*": that is, just as the fig tree (*Fichus natalensis*) is protected, so should our bodies be conserved and looked after. Another interesting saying, "*Emiti emitto gyegiggumiza ekibira*," taught that the young trees are the most important in the forest. This type of education ensured that actions needed for the survival and well-being of their society were taught and passed on from one generation to the next.

Community Care for the Environment

Because of the diversity of creative and productive activities of Baganda communities, occupational groups (fishermen, herders, etc.) provided the most readily accessible means for the people to take socially valuable action as well as express their concerns. These properly mandated autonomous and interdependent community groups contributed to decisions that affected them and played an indispensable part in creating a secure and sustainable society. Kiganda cosmology cultivated this sense of individual and collective responsibility, generosity, and justice among the people, and between people and the environment.

For environmental conservation to be achievable, every society needs a foundation of information and knowledge — a framework of law and institutions. The Kiganda framework involved all interests, and sought to identify and prevent problems before they arose. It aimed at sustainability, was adaptive, and continuously redirected its course in response to experience and new needs.

There was also a strong alliance of individuals, families, and community to control the degradation of the environment. For instance, among the hunters, there were regulations laid down for sharing the meat, depending on the relative contribution of every member of the hunting group. These regulations were always respected and adhered to.

Conclusion and Recommendations

These findings and discussions suggest that there is a cosmological basis to grassroots indicators as signs of environmental change and signals for conservation. In other words, cosmological principles are themselves a means of monitoring, measuring and reporting environmental change, particularly for issues related to eremology, or the study of drylands. Several principles of traditional conservation have been dealt with, including respect and care for life, conservation of ecosystem vitality and diversity, balancing resource use, indigenous forms of education, and collective care for the environment.

Separating conservation from cosmology is the main cause of our problems today. We have no moral or legal right to destroy what we have not even bothered to know. We cannot despise what was built out of the wisdom of many generations. It is up to us to understand and utilize what is in the ancient cosmologies for our present-day efforts. This rediscovery may gradually regenerate and restore "conservation culture" in countries such as Uganda.

Language and Grassroots Environment Indicators

Frederick Mwesigye

Communities all over the world have developed their own knowledge and practices for observing, measuring, and predicting environmental quality and change, which are embedded in their indigenous languages and cultural beliefs. There is little doubt that people at the "grassroots" have knowledge of their environment that transcends conventional social, economic and biological indicators.

However, the vocabulary of "environment" has seemed alien to most indigenous languages in Uganda. Consequently, local languages have remained outside the conventional understanding of the environment. This understanding thus fails to transcend social, economic, and biological barriers to reach a point of understanding the grassroots wisdom has already reached. This paper attempts to trace, very briefly, the limitations of the conventional wisdom about the environment, by means of examples from indigenous languages to interpret the meaning of environment indicators.

Knowledge Systems in Conflict

Management of the environment and individual natural resources like soil, water, air, flora, and fauna, has become an issue of unprecedented global concern. Yet the objectives of natural resource management, including conservation, quality control, and equitable distribution among people, often create more problems than solutions. There is also a need to study and act on these concerns across the various cultural, social, economic, and even political boundaries; otherwise knowledge and practice become two worlds apart.

The knowledge of the people at the "grassroots" has tended to be presented by outside observers. But these observers represent their own professions and disciplines. None of these professionals are people from the grassroots, and therefore grassroots knowledge is interpreted as "other," and by insinuation, understood to be "primitive" or "unscientific." Professional knowledge is therefore said to have the task of "educating" and "modernizing" local people.

What can we learn from this standoff? Is professional knowledge wrong and grassroots knowledge correct? Or is it the other way round? Neither seems likely. What can best be said is that there is a clash in worldview or epistemology between the two. This conflict is mainly produced in the already contrasting sociocultural (including linguistic), political and economic settings. Scientists can not read what the "skies" say; but neither can indigenous knowledge explain everything. When it is considered by scientists, local knowledge is removed from the web of meaning and influence from which it arises, and there is an attempt to fit it into the framework of Western scientific rationality. In this attempt, significant errors in interpretation and application have arisen.

Useful communication can be achieved if we avoid looking at a problem solely in scientific terms. This means that scientists must stop looking at the problem through the scientific prism only and learn from the "non-scientific" sources. In turn, people at the grassroots can learn from the scientists. In such a situation, language becomes a major instrument for transmitting knowledge. Without a language which is clearly understood by the grassroots peoples, we are risking one of our most valuable resources — original *solutions* derived from local knowledge. Because local knowledge comes from an oral culture, and remains codified in rituals, ceremonies, and even metaphor, useful practices become highly ritualized. Given this character of grassroots expression, its potential becomes lost because of inadequate translation and interpretation.

Poor translation of scientific knowledge into the grassroots languages, and *vice versa*, creates, in many instances, an "artificial knowledge conflict." In this conflict, scientific knowledge prevails and dominates because it forms its view from research experience conditioned by a particular set of sociocultural interests and value systems supported by the world's most powerful political, social, cultural, and economic structures. Faced with this knowledge backed by power, grassroots knowledge resorts to defiance and resistance. In expressing this opposition, grassroots knowledge seems to be incompatible with the scientific.

The Importance of Language to Communication

The way knowledge is articulated is directly limited by the positions taken by the community's sociocultural interests and values. Most grassroots communities are

organized according to these interests and values. In this organization, cultural beliefs shape people's perceptions, knowledge, and language of expression. Therefore, when we talk of the "environment," or "desertification," these terms must, first of all, be perceived by the grassroots communities the way we perceive them. Then, the knowledge we have must be translated into the local languages in order to be ritualized and practiced. This would set our perceptions and knowledge right into the complex social, cultural, political, and economic construct of the community. By so doing, the concept of "people's participation" will change from rhetoric to practice. How can we engage people without speaking to them in their language? Without their language, their society and culture is lost. This loss parallels the isolation of knowledge from society.

The concept of the "environment" is fairly wide. So is the concept of "desertification." But how these concepts are understood by the grassroots people is doubtless quite limited. I demonstrate this by means of one indigenous Ugandan language, Runyankore. The commonest translation of the word "environment" is *obutuura bwensi*. The literal translation of this term is "stability of nature." So this translation immediately restricts the idea of "environment" to nature, specifically to flora and fauna. Of course, we know that the "environment" is not restricted only to these narrow meanings. Let us consider "desertification" next. We know that desertification leads to a desert. A common translation of the word "desert" in Runyankore is *eihamba*: but in Runyankore, that word refers to a "bushy place without inhabitants."

Let us carry this example a little bit further. The main socioeconomic activity of the Banyankore people is cattle rearing, which is strongly rooted in their culture. In recent years, there has been a remarkable increase in exotic breeds of cattle such as Fresian. Crop-based farming is widely practiced, with emphasis on bananas and plantains. Coffee and other cash crops are also grown. Human population is on the increase, along with increased land use, which lead to land degradation and social conflicts over land availability and accessibility.

Environmental problems have developed. These include, among others, deforestation due to a lack of fuelwood, and depletion of natural forests and bush. At the same time, water problems are exacerbated, especially for the cattle owners; there is a reduction in available forage because of soil fertility loss and increased erosion. All these aspects of the problem, we have no doubt, relate or

constitute part of "the environment." How does this worsening situation relate to the definition of environment in Runyankore? In the work of Ibikunle-Johnson (1989) it was found that 45 percent of the respondents defined environment as *ebintu ebitwehingurize* (things that surround us), considering it a more appropriate Runyankore word than *obutuura bwensi.* The words do not necessarily convey the same concept. The use of the term *ebintu ebitwehingurize* could be used in discussions which moved away from simply talking about protecting the environment to monitoring and evaluating it. In this case, the Banyankore people noticed and explained changes in the environment, which can, in fact, be summarized as indicators including:

- changes in rainfall patterns;
- use of modern textiles instead of animal skins;
- reduction in vegetation;
- drying up of water sources;
- loss of forest cover;
- emergence of banana weevils and other crop pests and diseases;
- changes in the pattern of politics;
- loss of soil fertility;
- drying up of swamps;
- soil erosion; and
- loss of soil fertility.

This list, based on the work by Ibikunle-Johnson (1989), also reports to a lesser extent on indicators related to climatic change: attacks by wild animals, noxious fumes from vehicles, the extinction of certain wildlife, the increase in mortality rates caused by diseases like AIDS, the disappearance of medicinal plants, and other cultural changes.

We can, with a fair amount of confidence, conclude that the above changes reported as environmental indicators are a near-comprehensive translation. The two words used do not define the "environment" in the same way. Yet it is obvious that the term *ebintu ebitwehingurize* captures the "environment" concept. We also realize that this word captures all the above indicators. But this word is reported to be used by only a narrow section of the community (i.e., 45 percent).

Some Conclusions

It appears that very adequate, comprehensive traditional and cultural explanations for environmental problems are possible in grassroots languages. For example, the notion of "god" is an attempt to believe, by this community, that the environment, as a natural resource, is a God-given property which every person has not only the obligation to protect, but also the right to use.

This perception can exist alongside very modern and technologically based attempts to address environmental problems in Ruyanakore. It can include renouncing swamp reclamation, afforestation and tree planting, road construction and reconstruction, building of new schools and renovation of others, stopping soil erosion, construction and protection of spring wells as sources of safe water, construction of pit latrines, mass media programs on sanitation and good feeding, better agricultural practices, etc. The community understands very well that some types of human intervention have a negative effect on their environment.

On the translation of scientific concepts, it is fair to say that a scientific explanation without a clear lingual-cultural interpretation into the local people's language can result in a confusion of the causes, the indicators (symptoms), and the solutions of the topic being discussed.

Each community, with its history, culture, and environmental realities generally dictates the nature and extent of available knowledge and its dissemination. This reality calls for research into the various linguistic cultures of communities for a comprehensive understanding of the problems afflicting their societies. We are convinced that communities become more environmentally conscious through full dissemination of knowledge. No such dissemination of knowledge can take place except through their own day-to-day language.

Research Methodologies for Identifying and Validating Grassroots Indicators

Lemeck Kinyunyu and Marja Liisa Swantz

Introduction

This paper is based mainly on experiences in a donor-supported program, the aim of which has been to improve local conditions for sustainable livelihood. In this program, the "development agents" are working in close contact with communities, endeavoring to make use of local knowledge and respond to the needs, resources, and ideas arising in participatory communication with local people from all categories, classes, and walks of life.

Participatory approaches have been applied in one way or another in Tanzanian research for thirty years. Through participation, an outside interference attempts to become part of the *continuing process of local life,* rather than be a separate project or equipment brought to the people (*kiletewa*). Ideally, monitoring or measuring of development or environmental change should not be an isolated effort, any more than development should be a separate project divorced from people's way of conceiving their everyday life, and the ways people sustain their lives. How far this way of conceiving the outside interference can succeed continues to be an open question.

In the present atmosphere of donor-saturated development and environmental programs, money flows, loans are offered, per diems are paid, and allowances and salary toppings are dished out to such an extent that it is hard to expect anyone to move an inch without them. Can participatory methods be used in such an atmosphere for finding grassroots indicators?

"Participatory Research" and Grassroots Indicators

Participatory methods give outsiders a chance to learn how the local people live, what signs or signals they look for, and how they sustain their everyday lives. Local people look for signs and live by signs. For example, the people in Rwangwa subdistrict in Lindi Region wait until the *msonobali* and *mbambakofi (Afzelia quansesis)* trees begin to sprout, and they listen to the *chole* or *dudumizi*

bird's singing to know that the rains are near and the planting can start. Nearer to the coast, the blossoming of *mvule (Milicia excelsa)* and *mbambakofi* trees are signs of rain; star formations are looked for, and *kilimia* (meaning both "one to cultivate by" and the Pleiades) appears in a certain place in the sky. Wild *ming'oko* roots and *vitundi* potatoes (an important dietary supplement to the cultivated crops), begin to sprout, indicating that planted crops can do the same. Finally, lightning and thunder give assurance that the rainy season has started. The planting season is at hand.

If the bamboo trees start flowering, which they do only once in thirty years or so, people fear that the year ahead is going to be one of drought. Organic life offers the signs and symbols closest at hand. People living close to nature and living from nature learn the habits of other living creatures (animals, insects, birds) and relate them and the shapes, substances, and colours of organic life to their own organism and to their social and cultural life in general.

In recent years, interest has increased in what is variably called indigenous knowledge, people's knowledge, or what had earlier been referred to as ethnoscience (ethnobotany, ethnoagriculture, ethnogeography). All of these labels are used to distinguish it, as it were, from the "real" or "true" knowledge, which is modern science. But our question is, if people's knowledge is taken seriously, how can it be used, and how useful is it for decision-makers, planners or implementers?

Participatory work can reveal values and priorities which should be known when decisions on people's lives are made by governments, or policies are recommended by international agencies. On the other hand, values conflict with economic goals set internally and externally. Overemphasis on economic growth in abating the local or national impoverishment leads to commercialization of natural resources and encroachment of industrial and personal interests into the living space of populations. This, in turn, leads to a struggle for resources between the well-to-do and the deprived. The less-privileged react to the indiscriminate use of resources by the wealthy. They no longer feel bound to their former, more careful, use of materials. Outside investors rush in for resources, such as hardwood logs, or hunting grounds. There is rapid acceleration in the depletion of natural resources and environmental deterioration, leading to conflicts and competition in which the local people are the losers. Losers act in defiance

rather than as protectors of their environment. In the competition for diminishing resources, the indicators of people's own knowledge may no longer be tenable.

What, then, should the grassroots indicators be used for? As warning signs against the destructive direction of the world economies, which is resulting in increased poverty, whereby the resource base will soon be gone and people will have nowhere to turn? Can decision-makers accept grassroots indicators as guidelines? Indicators based on local knowledge are very "local"; they have to be known in each locality and they are based on a different level of experience from the indicators of the policy- and decision-makers. The latter group looks for general indicators, suitable for statistical purposes, and used by outside agents for interventions in distant places.

Even if the grassroots indicators were able to benefit the monitoring and reporting systems, communicating them to decision-makers has turned out to be an insurmountable difficulty. There are at present limited channels for open communication. Research continues most commonly to be an isolated process. Some research results and fragments of people's knowledge become current and are frequently quoted from one report to another. Then they become a common store of knowledge in international circles; but even then, the selection of approved knowledge goes through tight sieves which prejudice and reshape the local knowledge in the way which suits the economic and theoretical systems of outsiders.

The Concept of Participation

We shall first deal with the concept of participation, its strengths, and weaknesses; then we will elaborate on some of the uses of participation relevant to the topic of grassroots indicators. We will then go on to discuss the values and priorities and describe the types of socioeconomic indicators which, to our thinking, have more significance in identifying where the problem of planning, monitoring, and measuring "development" really lies.

The so-called "beneficiaries' participation in their own development" is at present part of the current development discourse. Great efforts are being made to apply the concept of participation in all the development efforts. It is featured

everywhere in donor documentation, and the World Bank is making a concerted effort to provide a guide for the use of this concept in development work. Participation is a necessary component in all grassroots methodologies. However, participatory planning and implementation, and even participatory research contain potential inherent contradictions.

Most often, participation as a concept is incorporated into the old notions of planning and research. Even the best-intentioned development agencies are caught by the fact that the "beneficiaries" have caught on too well to the notion that a development project always has to have a *mfadhili*, a donor. Action can start only after a project with its equipment or buildings "has been brought to us," *kuletewa*, even if this fact is camouflaged in a stage of initial self-reliant action to demonstrate that the people concerned are serious about the project. But if a project has a donor, it also has conditions which are laid down from outside. Participation has become a magic word for the donors, and a way to achieve success in projects shaped from the outside. There is hardly any way out of this state of affairs at present.

The vocabulary commonly used reveals the actual situation: participating people are still targets or beneficiaries of "aid" projects. They participate in the projects supported by donors, prepared through a complex process of planning and project documentation. In the case of monitoring this "development," the local people are expected to monitor activities set up for them by outsiders within the outsiders' value system. The actual "beneficiaries" are furthermore represented by community leaders and workers who are supposed to have an informed knowledge of the actual situation. The concepts of "environment" or "development" assume a uniform evolutionary process. Social formations, agricultural systems, animal herding, and other ways of living which do not conform to the concept of development or to the predominating environmental concept of conservation are to be transformed into a pattern prescribed for them.

Thus if participation is to be genuine, it cannot be predetermined in its scope or intention. The environmentalists and development workers among the pastoralists in the Bagamoyo District, the coastal groups around Dar-es-Salaam, and in the southern regions of Tanzania, have been frequently puzzled by the obvious unwillingness of the local people to take hold of "development," or to understand the necessity of conserving virgin forests as we conceive it. We have seen the

unwillingness of the pastoralists to reduce the number of heads of cattle in their herds, even in the face of reduced availability of land; or we have lamented the waste of money in endless ritual dances after the harvest season while the houses remain poorly thatched and half fallen. Why do "these people," whose knowledge we are now prepared to listen to, resist protecting the resources on the land which feeds their cattle? Why do the coastal people not only resist individual development projects, but seem oblivious to the total economic project as conceived in the economic centres of the world? Why do "peasants," who earlier used the resources in the neighboring forests sparingly, now burn down large stretches of them and cultivate in places they never have done before, as the conservationists are experiencing in Kisarawe or in East Usambaras?

Reversing the Search for Indicators

One way to find out peoples' real intentions is to carry out genuine participatory research with the people concerned, under their local conditions. Another way is to reverse the search for indicators and not worry about the poverty and environmental problems of the two-thirds world, but rather look for the indicators within the industrial societies dominated by the growth ideology. The symptoms of drought in the Sahelian countries during the sixties and seventies could have been anticipated when France started pushing them to grow oil crops to undermine the cheap soya oil beginning to flow from the United States to Europe. Whenever large stretches of pastoral land are alienated from productive use "in the interest of the larger public," the seasonal movements of people and cattle shift their course in search of new pastures. Recording local indicators and people's own understanding of what has caused their plight is of paramount importance, but this kind of information does not carry far. It is not in the interest of those who exercise power. The pastoralists' interests or the interests of ordinary villagers are said to conflict with so called "larger national interests." In reporting to the public about environmental hazards, the local actors become the culprits, while no mention is made of the ultimate causes of such hazards.

Insofar as research interests can be kept apart from the political and economic interests of the funding governments (which, in today's world, has become a rare situation), permanent research and monitoring units under the control of locally elected community representatives would go a long way toward supplementing the

strongly biased extension services and research or monitoring interests. The present specific forestry, agricultural, livestock, plant, insect, or animal science research stations, experimental farms, and plantations, which could be ideal places for monitoring early signs and indicators, often have little connection to, cooperation from, or participation by the local population — not even local dissemination of information. They could be restructured or supplemented by units based on genuine participatory principles which would take direction from the local communities' expressed needs, integrate members of the community as research assistants knowledgeable about the surrounding lands and communities, make use of local people's knowledge and resources, and their own experiments and experience, on which their farming systems and cattle practices are based. In mutual learning processes both sides benefit and an agreeable learning environment is created. In vulnerable rural areas which are subject to powerful administrative and commercial pressures from above, more continuity is needed than what sporadic research teams or commissioned inquiries can provide. People need two-way channels of information through which local knowledge, information and complaints can flow to the general public. Lessons can be drawn from the way people not yet caught in a consumption frenzy organize their lives if there are places and time for listening and observing in two-way communication.

Environmental and economic crisis will continue to deepen in Africa if uniform economic concepts and indicators continue to be used universally. Certainly, no country can isolate itself from the world economic system or organize a national economy independently from the rest of the world. But it is also true that by conforming and trying to adjust to the environmentally wasteful economic logic of the powerful, the economically weak but environmentally wealthy lose the advantage of being small and having close interaction with their environment. Village people cannot organize their lives from the distant world center: they can do it only with their own means and resource base as the starting point.

Alternative indicators for desertification must be sought among the class engaged in accelerating "economic growth," not first and foremost among the local people. Invasion by the science-based official knowledge, often falsely or belatedly claiming scientific truth, also constantly diminishes the value of peoples' experimental knowledge base and makes it irrelevant. Women in Mbambakofi were ashamed of telling us that they had resorted to digging wild but nutritious

ming'oko roots which were plentiful in their surroundings. Officers had laughed when this example was mentioned — that women made use of these roots for their daily diet — instead of finding out more about the ways they were used, and why. Questions on how the root was diminishing or spreading, the difficulties in obtaining or harvesting it, and experiments people had carried out to domesticate the plant, were lost.

The superiority of economic knowledge over people's own use of forests or their systems of farming, about which there is constant conflict between the agricultural extension staff and the majority of the local people, are themselves serious indicators that people's knowledge is neither listened to nor taken seriously. The certainty about the proper planting distances between plants, be they millet or maize or any other crop the people are ordered to grow, does not permit the "experts" to listen to farmers. For local people, the insistence of the advisers is the most easily read indicator that their resource base is threatened: they determine to secure their food supply by mixing crops and ignore the recommended space regulations. The outsiders need to learn the signs that the people at the grassroots give, even when they read them from the so-called experts' deeds and words, and turn them into opportunities for positive cooperation and mutual learning.

All these examples of development paradoxes, of which innumerable concrete cases could be quoted, give us a direction from which to search for "grassroots indicators," particularly the real indicators of diminishing resources and imminent food shortages. Economic thinking needs to be developed with more space and thought given to local resources and local economic circuits and with full control of action by the local people. Women are the most active actors in that circuit.

Background and Grassroots Methodologies

Leaving aside, or taking into account, the above arguments for the need to "reverse" the approach to thinking about and searching for indicators, we now turn to describing some of the tools that have been used in communication with local communities. As this work is based on the findings of research done in the Lindi and Mtwara Regions, it is perhaps appropriate here to give an overview of these two regions.

Both lie in the southeastern part of Tanzania. There is a coastal plain along both regions bordering the Indian Ocean. Adjoined to it is the Lindi plateau in Lindi Region and the Makonde plateau with a scarp face towards the Lulindi plains in the Maasai District in Mtwara Region. Administratively, the area is divided into seven districts: four in Lindi and three in Mtwara. The basic statistics are given below (1988 data).

Table 5. Basic Information on the Lindi and Mtwara Regions, Tanzania

	Lindi	Mtwara
Area	65 000 sq. km	16 720 sq. km
Population	647 000	903 000
Population density	10 persons/sq. km	54 persons/sq. km
Population growth	2% per annum	1.4% per annum
Infant mortality	151/1 000	161/1 000

The most heavily populated area is the Newala district in Mtwara Region, while the least populated is Liwale in Lindi Region, the most areas being uninhabited. The regions include the Selous Game Reserve in Liwale district and the two proposed game reserves of Lukwika-Lumesule and Msanjese in the Maasai District of Mtwara Region.

Both regions have similar problems of land degradation and deforestation due to the existing system of shifting cultivation and the use of fire to manage rangeland. As a result, there is a progressive decrease in the vegetation of the area and increasing likelihood of flooding, soil erosion, water shortages, and poor soil fertility. The nutritional and income status of the local people in these regions is very low.

The regional integrated project support (RIPS) program supports rural development activities in both regions. The RIPS approach identifies the communities' assistance needs, after which all implementations are done through participatory means and methods. The projects are not seen as interventions from outside agencies but as locally negotiated agreements between the rural people and the agents.

Below is a list of methods which have proved to be particularly effective in the Mtwara and Lindi Regions. It should be noted that these activities take place over time, and within a multidisciplinary approach using information from all fields (for example, forestry, agriculture, livestock, sociology, community development, etc.) The team is also familiar with the advantages and disadvantages of such tools as rapid rural appraisal (RRA) and participatory rural appraisal (PRA). Through discussions, walks, observations, semistructured interviews, and conversations with key members of communities and knowledgeable people (individually or in groups), a more thorough understanding of the people's knowledge base is gradually established.

Participatory Mapping

Maps are especially important where monitoring and evaluation are required. It is the people of the local community that know most about the area under study because they live and farm there. Maps, therefore, are used to learn quickly from rural people by using their collective local knowledge. They can draw several maps on the basis of their knowledge of historical events. These maps are valuable for exploring land-use patterns, changes in farming practices, constraints, depletion trends of forest cover, land deterioration, water, and crops. The local communities conduct the analysis as a group and reach a compromise that facilitates further action and communication.

This is advantageous to the outsiders, as it gives them a way to understand the trend of changes in the area under study, the way people think, their priorities, and their reasons for prioritizing things. In the RIPS program, this technique has been used throughout the whole of the Lindi and Mtwara Regions. The impact of this technique is that most of the outsiders and local community end up with a thorough understanding and documentation of their land resources, forest resources, village boundaries, and many other assets.

Time Lines

Historical profiles and time trends are used to understand important events or key changes between years. As such, they also help to focus on the future in terms of land use, climate change, soil erosion, population, tree cover, common property resources, etc. These techniques clarify key historical constraints, such as the

severe hunger in 1979 in the Lindi and Mtwara Regions, which reappeared in 1989. Detecting and understanding cycles of environmental change can help to focus on future action and information needs.

The key informants in this process are usually the elderly, both men and women. Secondary data and records can also be brought in for comparative information. Maps and models drawn on paper or on the ground can be used to help explore historical changes. Indicators feature in these time lines. For example, one could ask the elders to explain how they predict coming events, rains, etc. What is it that they look for? What enables them to see trends? Future possibilities can also be probed by asking questions such as: What happens if nothing is done? Or if something is done?

Tables 6 and 7 present examples of time lines for important events in Mbambakofi-Mnivata, and the use of cassava in Nanguruwe in Mtwara Region.

Table 6. Time Line of Important Events in Mbambakofi-Mnivata

1880s	First settlers
1952	Proposed forest reserve
1953	Construction of the Mtwara-Newala road as people started moving from valley
1959	Food shortage
1961	Few families settled in Mbambakofi
1967	Mbambakofi registered as a village
1968-69	Food shortage
1974	*Villagization Act* — people moved from valley and other areas to Mnivata-Mbambakofi
1980	Primary school opened in Mbambakofi
1989	Food shortage
1989-90	"Kuchakumi" farm introduced
1990	Flood in valley area
1991	Food shortage

Table 7. Time Line of Cassava Uses in Nanguruwe

1800s	Cassava introduced in the village as a minor crop used for brewing only
1945	Starts to gain importance as cash crop; starts to be used as food
1950s	Gains importance as food against traditional grains
1970s	Cassava becomes major food crop
1990s	Cassava main cash, as well as major food crop

Group Discussions

These may be groups convened to discuss a particular topic, like deteriorating environmental conditions or causes of soil fertility loss, either at a site where this is actually occurring or using examples of the areas. This technique can be used to understand how rural people perceive changes and certain events by using open-ended questions and probing for further discussion. This technique can also be used to create permanent groups with common interests which can monitor and evaluate changes in the environment regularly.

Informal discussions can also take place in private with individuals or in isolated groups. Great attention should be paid to the group dynamics during these discussions. Teams can also be mixed after initial discussions and changed according to different sessions.

Matrix Scoring

Matrix ranking and scoring is a participatory tool used to discover local attitudes to, and perceptions of, a topic of interest. This may be soil and water conservation measures, varieties of cereals, types of fruit trees, etc. The method can be used to determine the seasonality of several things such as drought, desertification, food availability, cash and labour demand. It is similar to the wealth ranking example discussed below.

Transect Walks and Participatory Transect

These are systematic walks with key informants through the area of interest, observing, asking, listening, looking, identifying different zones, seeking out problems as well as possible solutions. The findings can then be mapped onto a transect diagram. There are many different types of transect walks (e.g., vertical, loop, etc.)

This simple technique helps the outsider explore and discover the topography of the area of interest, its soil type, land use, catchments, forests, fields, and even buildings and other assets. As a basis for monitoring the trends in the depletion of forest cover, changes in land-use systems, and other purposes, this technique can be very useful. In this case, recording information and records of observed

events and changes is very important. Table 8 illustrates the transect walk approach.

Table 8. A Transect Walk Showing the Different Zones of Vegetation Cover (Mbambakofi)

Forest and shifting cultivation	Village	Forest-bush and shifting cultivation	Water holes, permanent fields	Forest-bush and shifting cultivation
Crops:				
Cassava Maize Sorghum Rice Nuts	Small gardens	Cassava Maize Sorghum Sim Sim Rice	Cassava Maize Rice	
Trees:				
Cashew	Coconuts Banana Mango Mbambakofi Orange Pawpaw Lemon	Cashew Bamboo Mbambakofi	Banana Mango	Cashew Ming'oko Mbambakofi
Soil:	Sandy loam	Sandy loam	Sandy loam	Sandy loam

Seasonality Calendar

Seasonal constraints to, and opportunities for, various actions or assessments can be explored by examining the work done each month and portraying it as a diagram using seeds and leaves to show fields with different crops. The local rainfall pattern, drought months, months of increased logging, frequent fires, as well as agricultural practices like land preparation, tilling, planting, weeding, and harvesting periods, can all be discussed. Additional information, such as the hunger period, periods of highest income, and ceremonies, can be included. Seasonal diagrams can be circular, in a table form or linear (similar to time lines). Table 9 illustrates a three-year agricultural calendar.

Table 9. Seasonality Calendar for Various Agricultural Activities (Mbambakofi)

	Month											
Item or activity	10	11	12	1	2	3	4	5	6	7	8	9
Rainfall			X	X	XXXXX	X	X	XXXX	X			
1st year: farm activities (new plot)												
Bush clearing	XX								XXXXXXXXXXXX			
Burning and farm clearing		XXXXXX										
Planting cassava			XXXXX									
Planting maize			XXXX									
Planting sorghum				XXXXXXX								
Planting rice				XXX								
Weeding						XXXXXXXXX						
Planting beans			XXXX									
Planting sesame				XXX								
Harvesting maize								XXX				
Harvesting rice								XXXXXX				
Harvesting sorghum									XXX			
Harvesting beans								XXXXXX				
Harvesting sesame									XXX			
Planting cashew nuts			XXXX									
2nd year:												
Tilling land	XXXXXXXX											
Planting groundnuts			XXXX									
Planting bambaranuts				XXXXX								
Earthing bambaranuts							XXXX					
Harvesting cassava	XXX							XXXX				
Harvesting groundnuts								XXXX				
3rd year:												
Harvesting cashew nuts								XXXX				

Wealth Ranking

The main aim here is to determine the ability of the community and its individual households to sustain their daily livelihood. There are inequalities and wealth differences in every community. The differences influence or determine people's behavior, coping strategies, and views. Investigating perceptions of wealth differences illuminates local indicators and criteria of wealth, and establishes the relative position of households in a community. Table 10 shows the ranking for 24 individuals in one village.

Table 10. Wealth Ranking in One 'Mtaa'-Nampoto Msangamkuu Village, conducted in Mtwara on 24 August 1993

Name	First ranking	Second ranking	Total score	Rank	Sex
Ali Salumu	33	25	58	1	M
Fatuma Saburi	100	100	200	14	F
Bakari Mwanya	33	25	58	1	M
Petungi Mwenye	100	100	200	14	F
Isa Salum	33	25	58	1	M
Abdala Salumu	33	50	83	14	M
Uvenani Ahmedi	100	100	200	14	F
Ahmedi Mwanya	33	25	58	1	M
Shaibu Mwenye	33	50	83	8	M
Abdala Malo	33	50	83	8	M
Rashidi Muhidini	33	25	58	1	M
Hamisi Salumu	33	25	58	1	M
Ahmadi Saidi	67	75	142	11	M
Laya Hasani	100	100	200	14	F
Sujai Hasani	100	75	175	17	M
Taluma Hasani	100	100	200	14	F
Ali Hasani	100	100	200	14	M
Mwanangema Hasani	100	100	200	14	F
Salumu Salumu	67	25	92	10	M
Selemani Salumu	100	75	175	12	M
Nalae Hasani	100	100	200	14	F
Ismaeli Mfaume	33	25	58	1	M
Kandiudi Mwenye	100	100	200	14	M
Selemani Salumu	100	100	200	14	M

The group identified 4 classes for rating:

I : Owe nothing, clay house, only food crops, but all have land.
II : Involved in fishing, but do not have enough to employ casual labourers and thus have no coconut farms.
III : Fishermen, with additional income from farming or a shop. Employ farm workers during fishing season and can thus go to Pemba, Kilwa, etc.
IV : Have large assets, like houses, accumulated through income from long-distance fishing.

Conclusion

Communities have their own "grassroots indicators" based on knowledge and practical experience gained over time. These measures differ by area according to environmental conditions and people's activities. They have been used for centuries to guide environmental and livelihood planning and action, long before scientific knowledge attempted to understand the processes of environmental change and development. Identification of grassroots indicators is a complicated process, and there is a need for more specific examination on how useful this information can be beyond the community level. However, it is certain that only through a participatory process can these indicators be identified and explored.

Identification of Land Degradation Levels at the Grassroots

Matthijs de Vreede

Introduction

This paper addresses the topic of land degradation in the drylands of Eastern Africa, and particularly, experiences in combining indigenous environmental knowledge and modern science in the context of the Elangata Wuas Ecosystem Management Programme in Kajiado District, Kenya. It argues that assessments of land degradation must be based on both objective yardsticks, such as indicator species, and factors, such as the use of species. Much can be learned from local populations, which know their land and are usually good observers.

The Limitations of Indigenous Dryland Management Systems

Ever since sustainable development began to feature prominently on the international development agenda, a lot of positive things have been assumed about the sustainability of indigenous management systems. It is not difficult to find examples of indigenous management systems that appear to work well in the short term. But in the historical context, and perhaps over periods of more than two to three decades, they tend to be less effective. For example, it can be suggested that the southward migration of southern Nilotic tribes in Eastern Africa was caused by the fact that they more or less overexploit their land until the grass on the other side of the hill (south of their location) became greener.

It is possible that most indigenous management systems in the arid and semi-arid regions of Eastern Africa do not have prevention of land degradation as their highest objective. Close scrutiny of communal land management systems often reveals that the main objective of some traditional systems was the prevention of conflicts among the rich, who profited most from the communal property. This is not a wholesale condemnation of traditional land-use systems, but a phenomenon which appears to be present in all communal land systems everywhere in the world. It has been documented, for example, with regard to the English "commons." In the traditional setting of Africa, this phenomenon was corrected by drought and epidemics. At regular intervals, hunger and illness offset

economic imbalances in the community. Nowadays, the rich immunize their cattle and build private surface dams, while the poor cannot afford veterinary medicines and must pay for the water they draw from the dams of the rich.

In the Elangata Wuas Programme area in Kenya's Kajiado District, it has been calculated that, during the recent drought, up to 70 percent of all livestock of the local Maasai people was lost to the drought and east coast fever (ECF). It appeared, however, that the losses were highest among the lowest-income groups, and that 10 percent of their loss was actually sold to pay for the water needed to keep the other animals alive. We also found that for about 30 percent of the population, the subdivision of their communal land (known as a "group ranch"), which is commonly seen as a potential disaster, might turn out to be a blessing. The Maasai living in this area now have so few cattle that they can sustain them on the plot they will receive. On that plot, their livestock will no longer have to compete with the large herds of the rich, who in many cases are not even members of the group ranches but nevertheless herd their cattle there.

The long-term failure of traditional management systems is, of course, also a matter of inadequate planning. This is not a criticism of local communities. As long as the most sophisticated and richest governments in the world cannot manage to accurately plan even one budget year ahead, we should not expect rural populations, whose preoccupation is with the next day's or next year's food, to plan their land use over several decades and under highly variable climatic conditions. Also, in the past, such long-term environmental failures were not a real problem. Migration resulted in greener pastures and the abandoned land had time to recover.

Inadequate planning, however, has contributed to the collapse of many indigenous management systems recently, under the combined pressure of population growth and limited access to land. Under these conditions, the poorest suffer most and cannot be expected to follow rules laid down by the rich and powerful. Their survival is at stake. Nevertheless, there is definitely a need to gain more insight into these traditional management systems, the land degradation assessment methods used, and their applicability to planning under the present circumstances. But these days, it is impossible to rely solely on indigenous knowledge for land degradation control and land rehabilitation.

Beyond Indigenous Knowledge

While I argue below that indigenous knowledge can be extremely valuable to land degradation control efforts, it is equally valuable to examine the argument that indigenous knowledge can lead only so far towards effective land rehabilitation. In the first place, traditional practices may have prevented land degradation in the short term, but they were not explicitly meant to do so. Neither did they put a lot of emphasis, if any, on the reversal of degradation processes. They aimed at the preservation of resources, or even the expansion of the resource base. For example, indigenous terracing systems on steep slopes should not be admired for their effectiveness in terms of erosion control. They may well achieve this end; however they were typically constructed to increase the amount of arable land on slopes that could otherwise not have been used. This has not only been the case in Africa but in other areas of the world. In the Middle East of around 3000 BC, and in Mexico until the 17th century, some communities engaged in the creation of gullies that ran from the tops of the hills straight down into the valleys to increase agricultural potential down below by guiding all soil and rainwater to where it was needed most. Today, the main issue is not only that land degradation should be prevented or stopped: it should be reversed wherever possible, and this objective requires a different approach to land management.

Secondly, there are certain indigenous land management practices, particularly in drier environments, that may need to be reconsidered. Systems that included grazing bans or rotational tilling may not survive because land must be used to the limits of sustainability. At the same time, some traditional management techniques have either been forbidden or have become too dangerous. Fire, probably the first management technique ever used by humans, is prohibited in most countries, as it has become too risky because of the density of human settlement.

Next, the disruption of traditional communities and their decision-making systems have made many people less willing to actually follow the traditional rules. The lowest-income groups in particular cannot afford to do so, while the rich may see too many advantages in breaking the rules.

Most indigenous management systems were developed in environments where the quality of the land was not determined only by human use and management. For example, most pastoralist societies in East Africa have the preservation of good grazing as their main objective of traditional management. At present, there is a reduction in pasture land not only because of overgrazing, but also bush encroachment, which is possibly the dominant indicator of land degradation. Bush encroachment results, to a great extent, from the disappearance of large browsers like elephants, rhinos, and giraffes. Thus as ecosystems become impoverished, land management must cope with new problems, to which traditional approaches may no longer be applicable.

Finally, traditional land management systems were used by independent communities that could decide how to use of their own natural resources. At present, these communities have to comply with the laws and natural resource regulations of the state, while at the same time becoming ever more dependent on both services and aid from the outside. This point is important, because this form of "development" may not work. Dependencies have been created by an outside world that orders and demands, but does not fulfill its own part of the deal. Most governments in Eastern and Southern Africa are unable to provide the needed services and assistance they have made their people dependent on. Inevitably, communities are left to find their own means of development.

The Significance of Potential Use

The land management issue is important for the Centre of Biodiversity of the National Museums of Kenya, the institution where I work, because the biodiversity of any piece of land depends largely on the way it is managed. The more people are forced to erode their own environment, the poorer that environment will be, and the poorer the people themselves will become. At the same time, management aimed at stopping or reversing degradation is an important tool for the preservation of biodiversity.

Land management and land degradation prevention have increasingly become issues for which the rural communities themselves are mobilized. The problem is not that we do not know how to stop land degradation and how to rehabilitate land. The techniques are fairly well-known and, when correctly applied, tend to

be very successful. The fact remains, however, that while the outside world says that local people and communities should carry their own responsibilities, be motivated and mobilized, these communities have no access to the other range of knowledge needed to fulfill their role.

One of the problems they encounter, for example, is that, in many cases, the problem cannot be solved by filling up gullies, reseeding grass, and planting trees. Most people know how to do that and find that it does not help in the long run, because the gully is not the problem, but a symptom. The problem is that in most cases the resource base is too small, exploitation becomes ever more intensive, and land degradation increases.

And there lies an important point: what actually is land degradation? There can be no doubt that land is degraded when there are signs like deep gullies and deforestation. Such land, in the eyes of the ecologist, is severely degraded because there are only a few remaining plant species — although these may be ideal sources of fodder in the eyes of the goatherd. When we talk about sustainable development, the mode of land management and land degradation assessment should be closely linked to the issue of potential use.

In many parts of Africa, land management has become first and foremost a matter of land rehabilitation. But what does that mean? A community that relies ever more on goats and sheep as cash on the hoof needs different types of land rehabilitation from a community that focuses on cattle, or one that relies on camels. Also, one of the most important tools in the battle against land degradation is diversification. The wider the exploitation of the resource base is, the more resilient the system of exploitation, and the lower the danger of increasing land degradation will be.

This is an important issue, because at present, with the emphasis on sustainable resource utilization, a whole range of new types of resource use is arising. For example, tourism is perceived as an option for the drylands. Insofar as this is true, there are also many poorly managed and highly degraded "parks" in Eastern Africa. It is, however, necessary to point out that each alternative land use in dryland environments, including tourism, may demand a specific type of land. Trophy hunting has become an important source of income for local communities in some countries: it requires bushy land. Game cropping, on the other hand,

needs open land. Game bird shooting, which can be an extremely profitable and sustainable form of land exploitation, needs barren soil.

Grassroots Indicators as Parataxonomy

It is becoming obvious, therefore, that as rural populations diversify their economic activities, land management has to adjust its objectives. This new mode of land management needs modern land degradation assessment methods, which should be implemented at the grassroots level, because the local populations themselves should decide on the type of land they need. Of course, these modern methods should incorporate indigenous knowledge. There is no doubt about that. But they should be based on the modern knowledge and expertise to which the local communities need full access.

As one of its activities to promote this type of modern land management, the Centre for Biodiversity of the National Museums of Kenya is involved in the Elangata Wuas Ecosystem Management Programme in Kajiado District. The main objective of this program is to establish a community-based sustainable management system on semi-arid land. The National Museums of Kenya cooperate in this program with the Kenya Wildlife Service and a local self-help group. Shortly, the African Wildlife Foundation will join the community wildlife services part of the program. Apart from community development aimed at equity and communal management, the program experiments with new modes of sustainable natural resource exploitation. Very much attention is paid, however, to empowerment. Still, when a community is to manage its own natural resources, it should possess at least a body of modern knowledge, and be able to gain access to more information. In terms of this empowerment, the program's most important activity began with the training of so-called "parataxonomists."

The term "parataxonomists" was coined in Costa Rica around 1990 by the Biodiversity Institute (INBios), which needed local people who could collect mainly plant materials, particularly in the rain forests, provide ethnobiological information and other indigenous knowledge, and act as guides to scientists and tourists. Scientists need local ethnobiological information within the Elangata Wuas Ecosystem Management Programme itself; in addition, the program has an ecotourism component, and as a result has adopted this combined approach to

training local "parataxonomists." This training started in 1992–93 and has been very successful. That is to say, it was successful in having young Maasai men learn the scientific names of plants and trees, assist scientists, and teach tourists. But these achievements served only the outside world. Apart from some income to individuals, the community as a whole hardly profited at all.

In 1993, therefore, the program decided to change the title of these parataxonomists to "environmental workers." Their tasks were to be mainly land degradation assessment, land rehabilitation, monitoring, and adult education. The new training program started with land degradation assessment and will shortly begin adult education training. Through this small group of presently four, and soon eight environmental workers, the community has access to the information it needs to make its own decisions on land use and land rehabilitation.

During the first part of the training, the parataxonomy component, it appeared that such training actually amounted to not much more than organization and refinement of already existing local knowledge. The local Maasai taxonomy is very detailed, and interesting because it provides unexpected insights in perceptions and indigenous use. The main difference between Maasai taxonomy and the scientific approach is that the latter is more structured and uses universal concepts. When one does not know and understand its structure and concepts, one cannot make use of modern information.

There are similar experiences with the land degradation assessment training. The program made use of a dryland evaluation system developed by the German Agency for Technical Cooperation (GTZ). This system uses a small range of indicators, including soil crustation, gully formation, the existence of small heaps of sand around the roots plants, vegetation cover, and hedging, or the tendency of bushes to produce more leaves on the inside when the leaves at the outside are too often removed. This system provided the organizational structure for land degradation assessment.

In the next step, which is currently underway, attention is paid to indicator species. The environmental workers and their trainers look together at the frequency and density of plant, insect, and bird species at various levels of land degradation, for various types of soils. Here it appears that the indigenous knowledge about species and animal behavior is very valuable. One of the

environmental workers identified the fact that termites prefer rather denuded land to build their mounds. This preference is possibly due to the absence of predators there. Scientific research in Northern Kenya conducted about twelve years ago, showed that each year termites were responsible for the off-take of an equivalent of 80 percent of the newly grown vegetation, while camels and small livestock take the equivalent of only 8 percent. Thus, once land becomes so denuded that the number of termite nests increases, the land degradation process may be accelerated. This is not to say that destruction of termite mounds should be part of a land management system. But this combination of indigenous and scientific findings warrants further research.

With its environmental workers, the Elangata Wuas Ecosystem Management Programme believes it has developed an important approach to land degradation assessment, and land management at local level that uses a mixture of scientific as well as so-called "grassroots indicators." The most important aspect of the system is, however, that it is viewed in its entirety as an ecosystem (and not only as a grazing system or pastoralism). This perspective makes it possible to take a wide range of new land-use opportunities into account.

PART 3

IMPLICATIONS AND IMPACT

- Changes in Environmental Conditions: Their Potential as Indicators for Monitoring Household Food Security
  Robert K.N. Mwadime

- Akamba Land Management Systems: The Role of Grassroots Indicators in Drought-Prone Cultures
  Wilhelmina Oduol

- Grassroots Indicators Among the Langi and Their Importance to District and National Planning
  Tobias Onweng Angura

- Pastoral Maasai Grassroots Indicators for Sustainable Resource Management
  Naomi Kipuri

- The Use of Trees, Birds and Animal Behavior as Measures of Environmental Change by the Shona People of Zimbabwe
  Claude G. Mararike

This page intentionally left blank

Changes in Environmental Conditions: Their Potential as Indicators for Monitoring Household Food Security

Robert K. N. Mwadime

Introduction

Food and nutrition monitoring and evaluation systems have found it difficult to use conventional anthropometric and caloric adequacy indicators. These indicators are criticized for their restricted response capacity, and for being expensive to incorporate into ongoing monitoring systems. Alternative indicators currently being sought are related to the behavior of the household. To produce accurate and timely information and allow effective interventions, indicators should be based on the observed response of people vulnerable to food shortages through the monitoring of people's coping behavior. Nevertheless, such data does not always relate to the decision-making process of the users. It depends on the outcome behavior of a decision (or a series of decisions) rather than on what directs those household decisions. Data collected to forecast the communities' or households' food situation should, for this reason, relate to, or be used to complement, the existing and used indigenous information.

The pattern of life of most rural societies in the semi-arid regions of Africa is largely determined by both processes acting at the village level and changes within their environment. These societies are no longer isolated or closed systems. They have been changing as they become more and more integrated into the world market economy, a process that has made them open and responsive to sectoral institutions. However, even with the ongoing changes in these traditional communities, local knowledge and experiences continue to play an integral role in rural livelihoods. Local knowledge transforms as societies change, but this knowledge base is still very useful in providing initial indicators for monitoring food conditions within households and communities in semi-arid areas.

The purpose of this paper is to identify factors (indicators) perceived by rural communities as affecting household food security[14] (HFS) and the changes (or indicators of change) in the household environment that are used by local

[14] Here, food security is defined as the ability of households to access sufficient food at all times of the year in order to ensure an active and a healthy life for every member of the household.

communities to monitor (and make decisions about) the adequacy of their future food supply. Findings from ongoing research in two communities in the Kwale and Mwingi districts in Kenya are used to identify indicators that could be useful to policymakers.

Background

Two research sites in different provinces of Kenya provided the context for this study. Kwale, in the Coast Province of Kenya, lies to the west of the Indian Ocean and north of the Tanzanian border. The district has a monsoon type of climate, hot and dry for most of the year, with bimodal rainfalls: the long rains are from April to July, while the short rains are in October and November, with a 60 percent reliability. Most precipitation falls along the coastline and aridity increases as one moves away from the coast. Msambweni, the specific research site for the study is 30 km from the coastal strip. The area is occupied mainly by the Digo people, the majority of whom are Muslims, with a population density of 57 persons/km^2. Coconut, cashew nuts, fruits, and a coloring known as "bixa" are the main nonfood crops, while maize, cassava, cowpeas, and rice are the main food staples. Rarely are large livestock such as cattle kept because of the lack of available pasture. Three-quarters of the households have at least one member involved in off-farm employment. Fishing is the most common income-generating activity in the area.

Mwingi is a much drier region and is located in Kenya's Eastern Province. The people are Bantu-Kambas and are mainly agriculturists. The area has a population density of between 18 and 66 persons/km^2. The climate is classified as hot and dry for most parts of the year. Rainfall, again, is bimodal, with the long rains between March and May, and the short in October and November. Generally, the rainfall is below 750 mm per annum for most parts of the district and very unreliable. There are long stretches of dry, hot seasons between August and September (immediately after the cold July), and again in January and February. Most rivers are dry through most of the year and there is limited intensive land use. The main food crops are maize, beans, pigeon peas, cowpeas, millet, and green grams, while sunflower, cotton, and livestock are the main sources of money from the farms. Off-farm employment is also a main source of income for many households in this area.

Food Insecurity in Kwale and Mwingi Districts

Following up on information gathered from the two communities, four areas of indicators of environmental change were investigated:

- the end of the dry season;
- the coming of rains;
- the adequacy of the coming rains; and
- the fertility of the soils.

Tables 11 and 12 illustrate the indicator, its meaning, and the action expected from the community. However, it is necessary to discuss what potential these indicators have for being compared across two communities, in different semi-arid contexts, but with food security as their same development need and livelihood strategy.

Table 11. Indicators from the Digo in Kwale District, Kenya

Issue	Indicator	Meaning of indicator	Expected action in the community
End of seasons	Migration of specific monkey	Moving south means weather will be increasingly dry; moving north means it will rain	Land preparation
	Movement of butterflies	Many butterflies moving north are indicators of rain	
	Budding of some trees (e.g. *mvungunya* or the "sausage tree")	Indicates coming rain	
Start of the rains	Change in winds; flow towards the North	The winds are colder and rains are closer (by days)	Land preparation
	Changes in the position of stars *chimira*	Cluster of 7-9 stars are in the 4 o'clock position in the east, and this indicates rain	Start planting
	Information given by fishermen on the "mixing" (inversion) of the sea water	Sign of changes "upcountry" (upstream) signals the coming of the rains	Continue planting

(continued)

Table 11. *(continued)*

Issue	Indicator	Meaning of indicator	Expected action in the community
	The presence of red ants	Appear on the day it will begin to rain or the days it rains thereafter	Continue planting
	Appearance of a big white cloud in the east called *kizimachenze*	Sign of the "last heat" and the rains are very near	Planting
	Lightning and thunder in the east	Rains near or started	Continue planting
	The noise of frogs in the wells	Frogs anticipate humidity and rain	Continue planting
	Feelings of some special people (diviners), especially older people who have had an operation	Old people are "tired and stiff" with impending rain	Continue planting
Adequacy of the rains	Migration of birds	Fewer birds appear, or certain bird species do not return, or those that return make a different cry: these are also signs of poor rains	Take risks and plant as much as possible; make plans to find alternative sources of income
	Sprouting of trees (especially the baobab or acacia)	Late sprouting or few leaves or flowers signal inadequate rains	As above
	Fruit production of some trees	If the local mango tree produces a lot of fruit, the rains will be poor	As above
	The nature of the clouds	If the *kizimachenze* clouds are mixed with other clouds, this will be a bad year for rain	As above
	Insects which come before the rains (*panzi*)	If these insects appear as normal, there will be sufficient rains	Farmers relax their risk taking

(continued)

Table 11. *(concluded)*

Issue	Indicator	Meaning of indicator	Expected action in the community
	Information from the fishermen on the appearance of mangrove leaves	If the leaves falling (leaning) in the sea water are "standing" the rains will be sufficient; if the leaves are "sitting" there will not be adequate rain	Find alternative food crops if the sign is negative; increase sale of coconuts and other nut crops
	The day of the week that the rains start	If the rains begin on a Thursday they will be inadequate: "the rains have fire"	Plan for alternative food and income sources
Soil fertility and productivity	Observe the health of the crop (colour, strength of plant, etc.)	If for two consecutive rains the productivity of the crops is low, then the soils are depleted of nutrients	Rest the soils (fallow); plant "land resting crops" (*kunde* or cowpeas and *pojo* green grams
	Observe species and health of the grass and weeds growing among the crops	*Mwamba-nyam, ngobwe* (creeping grass), *ugogwe, dago or ndago mwitu* (nut grass or papyrus grass) *munyumya* (sowthistle), indicate good, fertile soils	Plant any type of crops
		Rusi, chitsoma (*Striga spp.*) indicate poor, infertile soils	Do not plant crops; use for grazing or leave fallow

Table 12. Indicators from Mwingi District, Kenya

Issue	Indicator	Meaning of indicator	Expected action in the community
End of seasons	Migration of birds (e.g., *nzongululu* or *mbala-misye*) and their calls	Appear in August and stay until October (dry season): a good sign	Land preparation
	Birds' behaviour	Birds live with their offspring until November	Prepare seeds

(continued)

Table 12. *(continued)*

Issue	Indicator	Meaning of Indicator	Expected action in the community
	Sprouting of leaves in certain species (acacia)	End of the dry, hot season is coming; note that different species sprout leaves at different times of the year	Land preparation
	Germinating of specific plants (*mataa mwaka, nyeela atumia*)	End of the dry season	Land preparation
Start of the rains	Direction and type of winds	After the cold of July, there are strong hot winds blowing from the north; just prior to the rains there is no wind at all for a few days; the cold winds appear from the south and indicate the coming rains	Final preparations for planting
	Frogs make noise	Rain will begin in the next few days	Begin planting
	Certain insects *(chenze)* which are found in trees make noise	As above	
	Information from experienced older people	They refer to shadows, feelings in their bones, smells of the soil	If these people begin planting, others follow
Adequacy of the rains	Stars *(kienea)* are read by certain knowledgable people	If the whole cluster of these special stars change, or if the positioning of each star changes, then there will be inadequate rains	Farmers take risks more easily; they plant quickly and plan for other sources of income
	Duration of the cold season in July	If the cold lasts for 2 weeks longer than usual, the rains will be insufficient	As above
	Beginning of the dew and mist	If dew starts early then rains will end early	As above
	Frequency of rains	Long periods between the rain days means inadequate rains	As above

(continued)

Table 12. *(concluded)*

Issue	Indicator	Meaning of indicator	Expected action in the community
	Colours which form around the moon during the rainy season	If the colours appear different from their prism-like appearance, then the rains will be insufficient	As above
Soil fertility and productivity	Type of grass and weeds growing among crops	Soils are fertile if good species such as *kithangai or ngothe* appear	Plant any type of crop; if this is a new farm, plant cassava, millet, and green grams in pots
	The type of trees and vegetation around the area (outside cropland)	The older the forest, the less fertile the soils;	Do not clear the land for cultivation
		Many shrubs in forests of few trees indicate soil fertility;	This land can be cleared for cultivation
		If there are many trees with "top (buttress) roots", then these trees "have eaten the soil"	Do not clear the land for cultivation
	The type of soils with "oil" in them	Black soils have more oil and fat and are more fertile;	Can plant even before the rains begin
		Soils that are sandy or reddish in colour are less fertile	Wait to plant when the rains begin

In general terms, a number of factors are the same in both Kwale and Mwingi, although the specifics might differ. Both communities use the sprouting, shading of leaves or fruit of trees, and the movement of birds as an indicator of ending seasons; the changes in the direction of wind flow as an indication of coming rains; and "feelings" or information from experienced persons in the society, as well as the noise from frogs or toads, as an indicator of the start of rains.

Differences occur at the level of the plant or bird species, the direction of the winds, and the kind of informants in the community. These variations are likely caused by differences in climate, geography, and culture. Of course, the plant and

bird species would be expected to differ in the two areas, and fishermen can only be found in the coastal area. This suggests that the general category or classification system for "grassroots indicator" could also be found in other areas of the country (Kenya), although the specifics would change. For example, among the nomadic Boran of northern Kenya, the intestines of livestock (the way the intestines are situated and their constituents) are examined and this information and knowledge used to evaluate changes in the environment.

In comparing grassroots indicators across communities, it is noteworthy, that indicators used to monitor inadequacies are based mainly on deviations from a normal trend or sequence, including the duration and character of the particular events or conditions. For instance, the duration of a cold period, or the appearance of mist or dew, or the position of the cluster of stars, all signal a variation from a locally determined norm. An anomaly was interpreted as an indicator of change in the expected outcome, and in most cases it was a "worst-case scenario" of the expected condition.

It was interesting to discuss with local people the indicators of change in their environment that they perceived could be associated with, or affect, food security in their area in some way. Examples from Kwale included:

- the continual presence of certain grasses or weeds on larger and larger (or on more and more) pieces of land as an indication of reduced soil fertility;
- frequent attacks of their crops by wild animals, especially the large game, which was seen as an indicator of a generally poor or worsening situation in the nearby game reserves;
- changes in the taste, or an increase in the saltiness of drinking water in some parts of the community were seen as an indicator of dryness and inadequacy in the rains: this indicator also implied lower harvests during the previous season; and
- more and more cassava becoming the main dish in most households, which indicate reduced levels of self-produced staple food by the households.

An important observation during the progress of this study was that the communities are undergoing a significant transition. Most "traditional indicators" are unknown to young people (those less than 40 years of age), who are also more educated than their elders. Whenever they talked of "traditional indicators," they

were reporting what they had heard or seen from their parents. The younger groups confidently associated themselves with areas related to lightning and thunder, type and location of clouds, dates and months of the year, and wind direction, all which seem to be related to the modern practice of predicting weather conditions in any community. On the other hand, indicators such as the position and location of stars, dependence on informants also referred to as "community prophets," and generally more culturally based indicators, including the local names of the trees and shrubs used to predict the end of season, were mainly within the domain of the older groups in the communities. This suggests that most of the "traditional knowledge" lies with older generations in the community and that as these generations pass away, their knowledge may also disappear.

Reliability of the Indicators

An interesting finding of this study, corroborated in our discussions with local people, suggests that none of the indicators is reliable enough to be used individually to predict or monitor the environmental conditions that affect their food security. Rather, it takes a combination of indicators (a set of indicators) to influence planning and decision-making by the farmers. Households often take risks in their decisions. They will often go ahead and plant their seeds even when the "change in the direction of winds" or "a prolonged cold season" may individually indicate severe changes from the norm.

Moreover, communities attach different values to different indicators, with some being considered more reliable than others. When asked to rank the reliability of the indicators, both areas rated the changes in wind direction as the best predictor in the timing of the rains, while the nature of the clouds (known locally as the *kizimachenze*) and the day the rains started were ranked highest as predictors of rain adequacy among the Digo. The frequency and length of dry periods within the overall rainy season, and the colours around the moon (*kivuyu*) were ranked highest among the Kambas. The types of plants found on a piece of land were identified as the most reliable indicator of soil fertility in both communities.

Future Research Questions

The question which is now being considered in this research project is: What grassroots indicators could be useful in development planning and formal monitoring of food security in rural communities? A number of key characteristics might be considered. The indicators must be reliable and predictive in determining changes in the environment and in predicting the outcome of household behavior. An indicator should not only be known (what it is and what it means or indicates) by community members, but also used by them, if it is to be useful in policy formulation or program planning. It is therefore necessary to ask: Who knows these indicators and who uses them? The questions formulated at this stage of the research project are:

- What proportion of the communities knows these different indicators, their meanings, and their implications for action?
- What percentage of the community uses these indicators on a daily basis to monitor their food situation?
- What are the characteristics of the households that use these indicators?
- Are the indicators indeed predictive? If so, to what extent do they predict environmental changes or variation in food security?

Clearly, on the basis of the preliminary findings presented here, it is evident that grassroots indicators are relevant as alternative indicators for the monitoring and evaluation of food and nutrition issues at the household and community level. The argument has been made that if we can identify factors or changes in the "environment" that predict or influence household food security decisions, we will be closer to identifying early indicators of household food insecurity in rural communities. Information collected in Kwale and Mwingi in Kenya shows that a variety of indicators are known to the communities, although the value attached to different indicators varies, as does their reliability.

Akamba Land Management Systems: The Role of Grassroots Indicators in Drought-Prone Cultures

Wilhelmina Oduol

Introduction

Sustainable development in Africa has preoccupied, and indeed confounded the international community in the last decade. Development planning and implementation, which previously had focused on technical and economic considerations, has increasingly shifted to people-centred development. Proponents of this development approach emphasize human development, equitable distribution of resources, and long-term ecological sustainability as central concerns of development strategy. Embedded in this human perspective of development is the recognition that people's indigenous knowledge systems and their participation in development programs can play a major role in shaping the direction of these programs for suitable development.

Environmental protagonists who consider the human element as indispensable to natural resource management, especially in threatened ecosystems, have supported initiatives aimed at identifying and understanding local indicators which monitor and measure land-use management systems and environmental sustainability. These local initiatives, usually referred to as "grassroots indicators," have been defined as measures or signals of change in an environment based on knowledge derived from direct observation and practice, usually over an extended period of time. Because they have evolved through generations, grassroots indicators are culturally specific, practical, and based on trends within the community. Usually, the knowledge base is further defined by age, gender and occupation.

The opportunity to conduct this study arose from my participation as an anthropologist in a multidisciplinary team effort involving Kenyan, Israeli, and Dutch researchers funded by the Netherlands and Israel Research Program. This paper provides a case study of the land management systems of the Akamba community in the semi-arid area of Kivingone Sublocation of Machakos District, Eastern Kenya. A description is made of the grassroots indicators which have been developed over decades to monitor changes in soil types, colours and textures, cropping patterns, seasonality patterns, commencement of drought, and the coping mechanisms developed to counteract the observed signs. The

limitations of grassroots indicators for policy-making are highlighted, and suggestions are made on appropriate strategies for incorporating grassroots indicators into environmental planning and development.

The Study Area and Methodology

Kivingone village is a squatter settlement located in the Nzukini Settlement Scheme in Yatta Division of Machakos District. The area lies in the semi-arid regions of Eastern Kenya, and is bordered by Nairobi Province to the northwest. Rainfall is erratic and unreliable, with the annual average ranging from 500 to 800 mm, depending on altitude. The soils are sandy and low in fertility, limiting food production. The area is drought-prone, with food scarcity a common phenomenon. As a result, people concentrate on growing drought-resistant crops, including sorghum, millet, cowpeas, pigeon peas, and Katumani maize. The provision of food relief is a common phenomenon in the area and male out-migration to seek employment is high.

Kivingone village is composed of 82 farm households. The majority of the farmers are former squatters who were allocated government land formerly occupied by white settlers during the colonial era. Most of them have occupied the area for twenty years or more. However, intense rivalries have emerged as the area has been infiltrated by people from high-potential areas driven out of their own areas by land scarcity. It is thus common to find recently settled immigrants from surrounding areas like Kangundo, Mbooni and Kiambu farming land which is not legally theirs. It is equally common to find the chief's court and other administrative officers arbitrating land disputes amid flare-ups of violence and community discord.

Interviews were conducted over a period of two months. Informal research methods like focus group discussions, informal interviews, key informant techniques, and selected participatory rural appraisal (PRA) tools, like transect walks, were used. These techniques were validated by participant observation during daily interaction with the villagers.

During group discussions, men and women were interviewed separately to discern differences in environmental knowledge influenced by gender. This separation of

the sexes also encouraged spontaneity and discouraged any inhibitions due to expected modes of social behaviour. Similarity in age, educational status, and interests were considered while identifying participants for group discussions. Permission was obtained from the participants to use and document these findings.

Grassroots Environmental Indicators

Information gathered from the local community revealed that people have developed indicators and monitoring systems over decades based on existing flora and fauna to detect changes in seasonality patterns, predict the start of drought or rain, identify soil fertility, and generally monitor the state of the ecosystem. These indicators are then used to make decisions, and develop survival strategies and coping mechanisms in a drought-prone environment.

The depth of information on grassroots indicators by the respondents depended to a large extent on age, their intimate and continuous interaction with natural resources (e.g., farmers) and whether they were recently settled immigrants or longstanding inhabitants of the area. The young people (younger than 40) tended to be part-time farmers who largely adhered to what the rest of the farmers were doing in terms of land preparation, planting, weeding, and harvesting. Most of them are less aware of grassroots indicators as environmental indicators in planning their production activities.

Recent immigrants, on the other hand, rely on indicators from their previous environment, which they cannot easily transfer to the new area. As a result, they are hesitant and follow what the long-term residents do. Sex does not seem to be a key determinant of knowledge on environmental indicators. Of greater importance is age and continuous interaction with the environment. Gender is more relevant in terms of the fact that both men and women farmers have developed specialized knowledge based on observed signs and experience with climatic change, soil analysis, and seasonal fluctuations, which guide their daily planning and related implementation of activities.

The data presented in Table 13 illustrate that the community is aware of and utilizes indicators derived from their knowledge and observation of animal, insect, and plant behaviour to plan production activities. The flowering of various

species of acacia plants warn people to prepare land for planting and ensure that planting materials are ready. The behaviour of specific birds, insects, and animals warn people about the nearness or length of the rains. The migration of birds shows that the exact time the rains will fall cannot be determined, while the excited jumping of cows and goats occurs just prior to a downpour.

Table 13. Indicators Of Changes In Kivingone Sublocation, Kenya

Issue	Indicators		Expected action by community
Start of rains	Flowering and shading of various species of acacia plants	When the *kidhia* plant flowers, long rains are about to start	Advanced stages of land preparation and manure application
		The *Ekalatumia* plant produces fruit in September and turns reddish just before the short rains in October	Planting materials appropriate to the different seasons must be ready for planting when the rain starts
		The *Kiuki* plant shades its leaves and produces fresh buds just before the rains	Decisions and consultations within households on what to plant and where to plant
		The *Uaaya* plant flowers once, while the *Kinyole* and *Kilaa* plants flower twice to indicate nearness of rains	
	Bird behaviour	The *Itaambua* birds make thunderous noises continuously during the day	
		The *Katheka maia* bird makes noise during the night	
		Swallows fly in flocks across the sky	
	Insect behaviour	*Tuminzili* insects (dragonflies) jump up and down imitating the way the women plant with a *panga* (farm implement)	
		Grasshoppers chirp continuously	

(continued)

Table 13. *(continued)*

Issue	Indicators		Expected action by community
	Animal behaviour	Cows and goats jump about excitedly	
		Particular people in community, especially elders and medicine women and men, feel dizzy or determine the coming of rains by the shape of a person's shadow	
Start of rains	Nature of sky	Dark clouds move across the sky during the day	
		Moon becomes dull	
		Stars shine more brightly	
		Appearance of new half moon, new half moon's back points in direction of heavy rains	
		Whirlwinds appear just before rains in August and September	
		Sharp lightning just before downpour	
Break in rains	Dew in the morning		People hurry up the weeding before the rains recommence
	Light mist in the morning		
	Appearance of a rainbow		
Drought	Plant behaviour	Flowering of *Kivingo* tree, which usually never buds	Start storing food
		Kinguthe plant flowers before any other plant	Grow drought-resistant crops
		Plants turn yellow, wither and die	Buy grain from those who have harvested and store
		Appearance of cold, light mist called *miki*	Transfer cattle to relatives who live on fertile lands

(continued)

Table 13. *(continued)*

Issue	Indicators		Expected action by community
		Dry, cold and fierce winds sweep across the land	Migrate to empty government lands (*Syengo*) or employ herdsmen, send them with cattle to these lands, and check on them frequently; (however, those who settle on these lands retain previous homes)
		Very cold nights	Stock cattle pastures
		Increase in diseases such as measles, and appearance of numerous insects which destroy crops	Unthatch rooftops for cattle feed.
			Sell cattle and farms to buy food
			Some men run away, leaving wives and children behind
			Men migrate to seek employment elsewhere to feed families
			Women make ropes and weave baskets for sale
			Group formations increase, kinship affiliations and friendships are strengthened, as people grapple with problem of survival
Soil types and changes	Fertile soils	Soil red, heavy and sticky	In kitchen gardens where debris and other rubbish are thrown away daily, beans and other legumes planted
			Maize planted on anthill and other fertile areas

(continued)

Table 13. *(concluded)*

Issue	Indicators		Expected action by community
		Insects such as scorpions, ants around anthills, earthworms, snakes and rats found here	Sorghum, pigeon peas, cowpeas, sweet potatoes and cassava planted.
		Weeds such as *Ittungi, Mungoi Ikoka* (star grass) *Mukutu, Mbiu* and couch grass	Manure is added as soil nutrient, crop rotation, grow drought resistant crops
		Soil coarse, light and sandy	
		Songe, Ilaa, mutaa lamuyu weeds found here	
	Infertile soils	Formerly heavy, sticky soil becomes loose and coarse	
		Couch grass becomes weaker, especially if it grows near *mutaa* plant normally found in infertile soil	
	Changes in texture	Appearance of *Mungoi* weed	

Among the Akamba of the Kivingone Sublocation, the breaking of rains is indicated by the appearance of dew and mist in the morning, intense heat, and the appearance of the rainbow. During this time, people weed their crops. Once the mist and dew disappear in the morning and the clouds darken, people hurry up with weeding in case the rains prevent them from completing it.

Drought is planned for very carefully because it has such serious implications for subsistence farmers. Climatic changes illustrated by the observation of plant and animal behaviour caution people to make preparations for cattle protection, the storage of water, alternative economic activities and strengthened social relationships, which may provide additional financial and moral support.

Indeed, the community's knowledge of the environment is so detailed, and their planning so directly connected to environmental change, that any deviation from what is normal and expected creates confusion and hesitations, which may, in the

end, affect the overall yield for the season. We illustrate with an example recorded in the researcher's field notes, which describes such an occurrence during the planting season in Kivingone village:

> The *Ngalula/Ngenu cha miti* (rains which flatten plants) were expected, but did not occur in the normal manner. These rains occur for nearly two days during the month of February. While the villagers view them with trepidation, because the strong winds sometimes damage their crops, at the same time they are a sign that the next rains, which normally occur in March, will definitely occur, so people can plant further or replant if necessary. The *Ngalula* rains are particularly important because if they don't occur, people may mistake the long rains in March for *Ngalula* and fail to plant in time.
>
> A confusion arose when instead of the *Ngalula* rains occurring for two days, it rained continuously for nearly one week. The crucial question, therefore, was: Is this *Ngalula* or the long rains? Should people plant or not? Subsequently, some people went ahead and planted, while others waited for more sure signs which characterize long rains, such as the roaring of thunder, which could reassure them that they were doing the right thing by planting at that particular time.

While this example confirms the villagers trust in grassroots indicators for planning purposes, it is also a clear indication that grassroots indicators are susceptible to environmental changes, which poses grave limitations for long-term planning and implementation. This recognition has led some of the villagers to take risks and go ahead with planting while knowing full well that the indicators individually were not reliable enough. Instead, farmers watch for a set of indicators, such as the excited jumping of cows and goats, the croaking of frogs or the jumping of *Tuminzili* insects.

In some areas with a steady flow of migrants and new settlers, the indicators of previous environments may be inappropriate to the new environment. This results in confusion, misinterpretation, and hesitation in planning production activities. Indicators are very specific to certain environments and cultures.

Sustainable Development Planning

Notwithstanding the limitations already mentioned, it is widely accepted that local knowledge systems could play a vital role in informing and promoting development efforts. Indeed, there is ample evidence to suggest that not only are indigenous knowledge systems more sustainable than many recent development efforts based on economic models, but they could be used to supplement more scientific approaches to attain the much-desired but elusive concept of sustainable development. The challenge is no longer to convince the world about the validity of indigenous knowledge or human-centred development but on how best to bridge the gap between local needs, and the broader national, regional and international spheres.

A first step in this direction is to ensure that development planners, policymakers, and aid implementers give the ethical, spiritual, and institutional aspects of the indigenous knowledge system the attention they deserve. This implies that there is a need to determine ways and means of adopting and adapting local knowledge in the outside world.

Just as local communities adopt and adapt modern structures and innovations to suit their own circumstances, policymakers too could identify traditional social structures, value systems, and institutional frameworks which could be utilized for implementation purposes. For example, the local extension agent in Kivingone village often reminds the farmers about the urgency of planting on time by pointing out well-known changes in seasonality patterns. This strategy improves communication with farmers in comparison to more formal dissemination methods.

It is also logical to assume that indicators of indigenous technical knowledge cannot be fully effective in development planning without involving the actors. Strategies should, therefore, ensure that local people are active in the design, planning, implementation, and evaluation of program activities which utilize local knowledge. One advantage of this approach is that the local people feel their knowledge is important for development planning, and that they have ownership and control over the processes. At the same time, they are assured that their survival strategies are protected. Grassroots indicators can also serve to "measure" participation, preventing implementers from ignoring community involvement in conservation efforts.

Finally, it is worth noting that the lack of literature on locally derived indicators or grassroots indicators is a drawback for planners and policymakers. Studies on local knowledge should be increased and a database established both for reference and planning purposes at the local, national and regional levels, for comparative purposes. The local community should be involved in the entire research and documentation process. This could be done through initiatives and strategies determined by the local community. Collaborative work between local implementers and planners should consolidate modern procedures with traditional practices, ensuring the relevance of both to the environmental and cultural context.

Grassroots Indicators among the Langi and Their Importance to District and National Planning

Tobias Onweng Angura

Introduction

Since time immemorial, the Langi of Northern Uganda have relied on local knowledge and experience to predict events related to the environment, social life, politics, and security, and to take appropriate response. Such local knowledge or indicators have been critical for the survival of this group of people in terms of making relevant decisions. From colonial times to the present, policymakers and planners have ignored these indicators and at times branded them as superstitious. Development planning was done by means of modern scientific methods in offices without the involvement of the local people for whom the plans were made. The result was that the valuable knowledge and experience, which had guided a people for centuries in their struggle to live, were ignored and not incorporated into development plans.

It was only in recent times that the involvement of the local people in their development through the resistance councils (RCs), created in 1986, has been encouraged. But even then, because genuine participation is still limited, opportunities to incorporate local knowledge and experiences have been missed. Nevertheless, the current policy of decentralization of both administrative and financial power to the districts presents a very good opportunity to tap grassroots indicators and incorporate them into district development plans.

This paper describes indicators among the Langi and demonstrates their importance in making appropriate decisions for their survival. An attempt is made to show how they can be used to measure environmental deterioration and stress. Finally, ways the indicators can be employed in district and national planning are assessed.

The Langi of Northern Uganda

The Langi are a Luo-speaking Nilo-Hamitic group who occupy the middle North of Uganda, mainly in the Lira and Apac districts. History has it that long before

colonial times, the Langi came with the Karamojong and the Iteso from Abyssinia (Ethiopia), but broke off from the main Nilo-Hamitic group, moved north, and came in contact with the Acholi before finally settling in their present location.

According to the 1991 Population and Housing Census of the Government of Uganda, the Lira and Apac districts have an area of 12 038 km^2 and a population of 955 469, with an average population density of 79 persons/km^2 (ROU 1992). The area has two seasons of rainfall and one long dry spell. Originally pastoralists, the Langi have now become agropastoral. The area suffered from many years of cattle rustling and civil strife, which destroyed the economic and social infrastructure of the area. With the cessation of civil war, crop production and trade have improved and the local economy is growing. However, soil fertility, though still fairly good, is gradually deteriorating. The process of urbanization due to rural migration is increasing. Nevertheless, though affected by modern influences, the traditional way of life guided by traditional knowledge and customs is still fairly strong.

Environment Indicators Among the Langi

Grass and Soil Fertility

Among the Langi, the kind of grass in an area indicates the level of soil fertility and its suitability for crop production. Tall, large-leaved spear grass, or *obia*, in the local language, indicates that the soil where it is growing is fertile, while short, thin-leaved spear grass shows deterioration in soil quality. Similarly, while elephant grass (*agala*) indicates soil fertility, *Striga*, or *alyeri*, signals a seriously exhausted soil.

This knowledge is gained through experience in land management over time, and helps farmers to decide on appropriate land-use planning in terms of allocation of land to crops, livestock, buildings, etc. For instance, even if a certain type of grass indicates fertility of soil, it may only be suitable for growing certain crops: thus soil with tall spear grass on it is more suitable for growing cassava than beans.

The following is a list of local names for grasses which indicate the quality of soil on which they are growing. These grasses indicate fertile soils: *odunyo*, *ototo*, *obogo*, *modo*, and *acanonya*. Grasses which indicate infertile or deteriorating soil quality include *ocwici*, *eryete*, and *acakacak*.

Star Patterns and Seasons

Among the Langi, the alignment of the stars, or *acere*, indicates either rainy or dry weather. Stars which are concentrated and divide the sky equally into two patterns indicate a normal "balanced" dry and wet season. A band of stars more to the east indicates the disappearance of the wet season and the onset of the dry. Another indicator which confirms the arrival of the dry season is the appearance of numerous bright stars scattered in the sky. When the band of stars lies to the west, it indicates that the wet season will still be long in coming. This indicator helps the people decide whether to plant or not, and which crops to plant. For example, when the pattern of stars indicates that the wet season is still long, people can continue to plant crops. But when the stars indicate that the dry season is soon approaching, a decision is made not to plant crops except those like sorghum (*bel*) and certain types of beans (*welo owoto me akaa*) (small and white) which resist drought conditions.

Birds and Insects

Birds and insects are two of the most important categories of "grassroots indicators" for local people. The appearance and activity of birds and insects are very important to people's farming activities and their strategies to maintain household food security. For example, the appearance of *okwiji* birds shows people that this is the right time to prepare the soil for cotton. This bird usually comes between the months of May and June when the millet crop is ripening and interplanting of cotton takes place.

The coming of the white migratory birds (*araptela*) in January is usually followed by an invasion of army worms, which can destroy young millet crops. This can lead to famine, depending on whether it rains after their appearance. If the advent of army worms is followed by heavy rains, the harvest will be very good, because the rains kill the army worms, which in turn fertilize the soil. On the other hand, if the coming of army worms is followed by little or no rain, this indicates famine,

because crops, especially millet, will be destroyed and no harvest will be realized. The phenomenon of the army worms, therefore, alerts people to a possible famine so they can take appropriate action to counteract it by economizing their food resources (for instance, by eating just one meal a day). But a response to the emergence of army worms is difficult, because it comes during the planting period when food resources have dwindled.

An invasion of locusts is known among the Langi as certain tragedy. When the locust invasion begins, the cloud of locusts is so thick that it blocks the sun. Locusts indicate certain famine, as the insects destroy not only the crops but every single plant they encounter on the land. Thus other sources of food, like livestock, are affected. Locusts also cover a far larger area than army worms.

The normal response to such an event is for people to turn on the locusts as a source of food as well as economizing other food resources. But locusts as a food resource may not last long, while the famine they cause lasts much longer. Fortunately, a locust invasion is a rare phenomenon among the Langi. People in Lango remember 1949 as the year when the last serious invasion occurred. Another minor invasion of locusts occurred during the mid-1960s. There has been no locust plague since then.

Grassroots Indicators, District and National Planning

As indicated in the introduction, local planning guided by local knowledge and experience has been operating independent of district and national plans since colonial times. This fact suggests that the policymakers have not genuinely involved the local people in all forms of development planning, including anti-desertification planning and programs.

The establishment of the resistance councils and committees (RCs) in Uganda in 1986 was a first significant attempt to democratize decision-making by involving the local people in planning and development. This was due to the realization that for development plans to attain their objectives, the people must be involved. Earlier development planning in Uganda had failed because of the failure to involve local communities in the planning as well as implementation of development plans.

The *Local Government (Resistance Councils) Statute* of 1993 was a refinement of the 1986 decentralization policy. This statute was designed and passed as an enabling law that opens the doors for a continuous process of decentralization and creates a framework for autonomous decision-making. This involves devolution of administrative and financial powers to the district and urban councils. These councils are also under obligation to devolve or delegate powers to lower levels of government.

The decentralization policy presents a very important opportunity for the district planners to incorporate local knowledge into the districts' plans. This is because with the structures of the RCs in place, the planning process should begin from the most local level and be pushed upwards to the district level. For example, the changing state of soil fertility for the whole district can be obtained by identifying, with local people, the types of grasses that are dominating areas of their local environment. A local and district vegetation map can be compiled, which may indicate large areas of *Striga* and thin-leaved spear grass growth. The state of soil in the district can therefore be said to be deteriorating, and plans at the local and district levels could be devised to respond appropriately to this degradation. Similarly, by using local knowledge, the pattern of occurrence of army worms can be established at the district level. This indicator will enable a food security strategy to be developed to minimize the effects of famine arising from the destruction of crops by army worms.

Inevitably, such processes must include sensitization and capacity-building at all levels if development and antidesertification planning is to be improved. Local people need to feel that they can include their knowledge and experience in planning, while government and NGOs at the district and national levels must learn to appreciate and incorporate local knowledge.

Pastoral Maasai Grassroots Indicators for Sustainable Resource Management

Naomi Kipuri

Introduction

Grassroots indicators are features of indigenous knowledge systems which provide the means through which communities live, produce, conserve, and reproduce their natural resource bases. Indigenous knowledge systems have evolved through trial and error as a natural process of human beings interacting with environmental forces for the purpose of ensuring survival, progress, and preservation of that community. It is these systems that have contributed to ensure the perpetuation of the natural resources we now enjoy both on national and international levels.

Local or indigenous knowledge systems have been variously described as ethnoscience, traditional wisdom, etc., but they all fundamentally refer to a body of knowledge that evolves over time and is communicated orally from one generation to the next. Riddles, proverbs, songs, and other oral forms are means by which indigenous knowledge is transmitted (Kipuri 1983). Indigenous knowledge systems refer to sets of concepts, beliefs, and perceptions comprising the stock of knowledge as well as the process by which it is acquired, augmented, stored, and transmitted (Tadingar 1995). Like any other knowledge system, indigenous knowledge is dynamic and ever-changing through creativity, innovation, and borrowing from other knowledge systems. It holds practical value for mounting cost-effective, sustainable, and culturally acceptable options for appropriate development problem solving.

In Eastern Africa, most of what is left of natural resources is located in arid and semi-arid areas occupied primarily by pastoralists. The latter are particularly known in the region for their extensive knowledge of environmental resources and their management. Their knowledge covers the preservation of the ecosystem through extensive ranching and rotational grazing, and the use of a variety of livestock that utilize different flora.

This paper discusses the importance of Maasai indigenous knowledge systems in the utilization, management, and preservation of the natural resource base. It also examines the relevance of indigenous knowledge systems in the diagnosis,

treatment, and control of human and livestock diseases, and the impact of ideological perceptions on the effectiveness of these systems. It argues for the integration of these knowledge systems into development agendas and activities for the realization of sustainable and meaningful development for the Maasai and other pastoralists.

Background

While all communities possess their own knowledge systems, a combination of factors having to do with official neglect and the resilience of pastoral social formations, have made this group the custodians of probably the most extensive of indigenous knowledge systems, and especially of knowledge about the semi-arid and arid environments in Eastern Africa. In Kenya, pastoralists include the Maasai, Samburu, Turkana, Rendille, Borana, Somali, and others, all of whom reside in arid and semi-arid areas of the country. Such areas comprise 88 percent of the country's total land area and carry 70 percent of all domestic livestock.

The Maasai live in southern Kenya and northern Tanzania, a region that is largely typical of arid and semi-arid lands. These lands are defined on the basis of climate, ecology, and land-use characteristics. Semi-arid lands receive annual rainfall of between 500 and 800 mm. High evaporation rates and shallow soils make the region ecologically fragile when subjected to intensive use by human and animal populations. Kajiado District in southeastern Kenya, where the research for this paper was carried out, receives an annual rainfall of 765 mm which ranges from 400 to 750 mm, according to altitude. The low altitude of the plains gives rise to low rainfall and high evaporation rates, while high-altitude areas like mountain slopes receive rainfall of over 800 mm annually, with lower temperatures and evaporation rates. Accessibility to pockets of high-potential areas is essential for optimal pastoralism, as well as for the maintenance and sustainability of the range ecosystem. However, it is the high-potential areas that have been proclaimed national parks or game reserves and protected forests.

The dryland regions of Kenya, like many other countries in Eastern Africa, are fairly isolated from the main centres of development. These areas are generally inaccessible because of poor communications, roads, and other infrastructure. As a result, modern health care for human beings as well as livestock is often

unavailable or intermittent. Pastoralists have often learned to do without such services, and instead depend on cultural and indigenous means of bridging this gap. Where services are provided intermittently, a combination of modern and indigenous knowledge systems is often evident. This, essentially, explains the resilience of indigenous cultural practices and knowledge systems, including human and animal disease control systems. Similar factors have contributed to the retention of indigenous forms of range and livestock management for long-term sustainability.

Indigenous Environmental Indicators

The significance of the natural environment for the daily lives of the Maasai pastoralist is contained in the knowledge of the environment and its resources, as well as the uses to which environmental resources are put. Trees and shrubs, besides providing fodder for small livestock, have many other uses, the primary one being their medicinal value. This emphasis is contained in the similarity of the word for tree (*olchani*, pl. *ilkeek*) and the one used for medicine, since the latter is essentially derived from trees and shrubs. Plants used for the treatment of various ailments are numerous and most of them have been very effective. This makes the preservation of environmental resources even more important. It also means that indigenous knowledge, developed after many years of experimenting with the various plants, must be protected and recorded.

Human Health and Environmental Indicators

For the Maasai, the environment is a myriad of plant species that have special value beyond simply providing fodder for livestock. Plants provide special ingredients that have proved effective in the treatment of human ailments. The chemical contents of some plants are known to affect disease-causing organisms in desirable ways. Different plants are also known to contain similar chemical contents, and can be used as substitutes, depending on their availability in a given locality. Some plants are only found in highland areas (*isupuki*), others only in lowland areas (*ilpurkeli*). While causes of disease are not always known among the Maasai, many environmental changes are known to be responsible for illness. Weather fluctuations are said to lead to ailments such as colds and fever, and altered food and water may also transmit diseases. They know, for example, that

malaria, *oltikana* or *enkojongani* (lit. mosquito), is most prevalent after heavy rains, when mosquitoes are numerous.

Human ailments are treated with the leaves, roots, or bark of various plant species. The part of the plant to be used often depends on the prevalence and size of the particular plant. The roots of a rare, slow-growing tree would rarely be used, if at all, to ensure a sustainable supply of the medicine. Its leaves or bark would be used instead. The conditions treated this way range from headaches, stomach worms and other stomach ailments, colds, venereal diseases, chest complaints, malaria, cuts and bruises, eye diseases, and many other conditions.

Commonly used herbs include *Acacia nilotica*, known locally as *olkiloriti*, which acts as an antibiotic, a digestive, and also an excitant. Others include *olkokola*, *esumeita*, *olmugutan*, *iseketek*, or *osokonoi*, mixed either with milk, water, or soup.[15] These medicines are often taken just to maintain good health. The common cold, for instance, is treated with *osokonoi*, *iseketek* and *olchani lolpurkel*, depending on the availability of the particular herb. For venereal diseases, *olkokola*, *olmakutukut*, *olamuriaki* and *olchani onyokie* may be used. Stomach worms were successfully eliminated with *olmugutan* and *iseketek* mixed with boiled water. Scabies has three types of treatments: the sap of the *oltiamae* tree; spreading soda ash (*emakat*) over the affected parts; or covering them with the hide of a sheep that has been freshly slaughtered and leaving it on for some time. Trachoma and other eye ailments are common among the Maasai because of the prevalence of flies. They are treated with the sap of three types of plants: *enkilenyai*, *olorrondo* and *osuguroi*.

More serious human diseases have also been part of the health environment interface of Maasai indigenous knowledge. For many years before the discovery of chloroquine as treatment for malaria, the Maasai discovered that the barks of the *esumeita* and *oiti* trees provided effective cures for malaria, as did the roots of the *olkinyei* tree. All these trees have a very bitter taste, as chloroquine does. All three are still used in areas where modern medicine is not available. More interesting is the fact that long before inoculation was introduced in the region, the Maasai used to inoculate people against the deadly small-pox virus (*entidiyai*). The author's grandmother was inoculated against smallpox as follows: scratches

[15] These local names have not been translated into their Latin/scientific equivalents at this early stage of the research project.

were made on her arm and small amounts of pus obtained from a dying patient were smeared into the scratches.

Clearly, from these examples, it can be see that Maasai have an extensive knowledge of their environment. The availability and uses of environmental products are, in fact, indicators of the deep appreciation among these people of the vitality and sustainability of their environment, as well as for their survival as a society.

Range Management Indicators

Good herd management involves, first and foremost, ensuring that productive range resources are available on a sustainable basis. This is accomplished mainly through collective use of the range and its renewable resources: pasture, water, and salts. Owing to variable environmental conditions, most pastoralists tend to secure the necessary natural resources through membership in social groups and through territorial alliances. Although among the Maasai some watering holes are owned by the persons who dig and maintain them, it is implicitly understood that access to them cannot be denied.

Under a communal land tenure regime, members of the group use the range independently of others, but under regulations and rules commonly agreed upon. The group may be a lineage, a clan, or an ethnic group, and the individual acquires rights to the territory by virtue of being a member of the group. Among the Maasai, there are fifteen such groups, each occupying a defined territory which may be used by others only through negotiation.

Pastoral organizations are also characterized by well-defined and extensive *ad hoc* institutional arrangements that facilitate transactions within and between other pastoral communities at various levels. Such arrangements are essential for the sharing of resources and redistribution of livestock after droughts or epidemics. The ultimate purpose of such arrangements is to secure the material conditions of social reproduction of the communities (Tandingar 1995; Miaron 1994). Such arrangements do not exist in conventional commercial ranching in Kenya.

Once all livestock herders of a given community are assured access to range resources, what remains is the management of that habitat for sustainable optimum production of forage. This environmental preservation and sustainability was

traditionally accomplished by seasonal movements of livestock — to the lowlands during the rainy seasons and to the highlands during the dry. These transhumant strategies are not solely restricted to wet- versus dry-season movements, but can be dictated in any season by formal and informal regulations relating to frequency of utilization of a given range. These arrangements provide for herd dispersion, pasture rotation, protection and regeneration, and in this way avoid undue stress on fragile range resources. Areas near settlements are reserved and enclosed for the use of small, weak, and old livestock, ensuring other livestock is dispersed, again to avoid overuse of the settlement areas.

The pattern of resource use by pastoralists is predicated on the avoidance or reduction of risks: hence the provision of flexible mechanisms that permit relatively free livestock movement, dispersal, separation, and the splitting of herds. These patterns are deliberately planned as responses to specific needs, contrary to the view that they are haphazard arrangements. Maasai movement of livestock, therefore, serves both ecological and socioeconomic purposes in achieving adaptive and survival strategies.

Diversification of herds also offers nutritional benefits by ensuring that the combination of different livestock species with slightly overlapping dietary habits, water and management requirements, results in a more efficient use of the range and helps in the allocation of range resources in the best and most flexible way possible. Cattle, camels, sheep and goats, all have different but not necessarily competing requirements. Browsers and grazers may be pastured together without competition or undue stress to the resource base. At the same time, some leaves and grasses are known to be good for increasing milk yields, while others are known to be good for fattening livestock (Sindiga 1994; Allan 1965). During periods of drought and fodder shortage, the Maasai, as well as other pastoralists, are known to practice methods of controlled breeding for various livestock, which include the use of penile sheets to allow breeding of sheep and goats only during the rainy season. While ensuring ecological balance as well as livestock health, such techniques allowed pastoralists to ensure that the required labour input for the optimum management of livestock was also taken into consideration.

The Maasai monitor changes in range conditions constantly to determine the effect of management actions and practices. They have developed various sampling and surveying techniques to quantify forage type, quality, quantity, and the condition

of other range animals. Livestock and wildlife behavior may be used to determine the value of the range. Milk yields are a common indicator of forage availability or shortage, as well as quality. The condition of the animal's fur, mating frequency and color and texture of the dung, all provide useful indicators for the assessment of the quality of the range. This holistic set of indicators provides indices of environmental stress, relating both to occurrences at a specific point in time, and as change over time.

Animal Health and Environmental Indicators

The Maasai have devised fairly extensive methods of detecting livestock diseases, mechanisms of combating them, as well as methods of preventing animal health problems, derived from the extensive information they have about chemical substances contained in various flora. The diagnosis of animal diseases is made on the basis of symptoms, as well as the course and known vectors of the disease. This knowledge is often comparable to the conventional knowledge of the modern veterinarian. The Maasai have fairly extensive diagnostic skills for contagious cattle diseases, as well as interventions, including surgery and inoculations.

An interesting example of this knowledge base is found in the local treatment and control of malignant catarrh fever (MCF), known locally as *inkutukie olchangit.* While the Maasai had no cure for MCF, they kept their livestock strictly away from the wildebeest and from surface drinking water during their breeding season. This precautionary measure is derived from indigenous knowledge and experience of the course and the vector of the disease. For centuries, the Maasai were convinced that the wildebeest was the silent carrier of MCF. They believed the disease was contained in the fetal membrane fluids of calving wildebeests. Only recently have scientists concurred with this pastoralist view (Miaron 1994). Scientific examination of this problem has added the knowledge that the virus is also carried in the nasal mucus of the wildebeest. While the indigenous measure did not attempt to eradicate the disease, it made it possible, for domestic as well as wild animals, to coexist and utilize the same range at different times of the year. This also conforms with the general pastoral philosophy of coexistence, which has contributed to the preservation of biodiversity.

Other serious livestock diseases have not been able to benefit from the combined usefulness of indigenous and modern knowledge. Maasai treatment for foot and

mouth disease (FMD) or *oloirobi* is the use of the sap of a plant known locally as *olmisigiyioi* but unfamiliar to modern science. Magical means are also used as control mechanisms: for example, the branches of certain plants are considered propitious (e.g., *eseki*) are placed at the gateway of the homestead for four days. During this time, no visitor is allowed to eat or drink anything in that homestead. The movement of livestock from one area to another is controlled, and the sharing of water sources prohibited during the time of the epidemic. However, since the separation of the affected animals from the rest of the herd is usually difficult, and often impossible to ensure, the local treatment of FMD has not been very effective. Western science also has no cure for the virus.

To treat east coast fever (ECF), or o*ltikana*, according to Maasai indigenous knowledge systems, the inflamed lymphatic glands are cauterized with a hot iron. The animal is also given an herb known as *enchani pus* and blessings. This control mechanism has not been very effective as a cure for ECF, but neither has any conventional method. ECF is still the worst cattle disease in Eastern Africa despite many years of research by two very renowned research centres: the International Livestock Centre for Africa (ILCA) and the International Livestock Research in Animal Diseases (ILRAD).

Fire is a controversial range management technique in many parts of the world. It was also used as a control method for disease-carrying ticks by the Maasai. Any use of fire is now illegal: this has encouraged bush encroachment and multiplication of tick populations, and hence an increase in tick-borne diseases. Although antibiotics are widely used, a lack of knowledge on the proper dosage and the conditions for which they should be used is lacking. As a result, misuse of antibiotics such as terramycin is very common to the extent that many tick species have become resistant to both indigenous and modern control mechanisms. The uncontrolled use of acaracides by the pastoralists has resulted in the evolution of new strains of ticks in these areas.

Moreover, despite the effectiveness, convenience and safety that modern drugs potentially provide for veterinary purposes, the problems of cost, availability, and accessibility still pose serious constraints in remote and marginal pastoralist areas. This isolation has, however, tended to ensure the resilience of indigenous knowledge systems for prophylactic and therapeutic treatments.

Significance of Pastoralist Knowledge and Indicators

While custodians of indigenous knowledge systems have largely retained, and still observe, many aspects of indigenous knowledge, modern development interventions, along with the associated ideological perceptions, have progressively undermined it. This process began during colonial domination and has persisted to the present. During this time, the ideology of the colonialist and that of the educated elite has been concerned with the promotion of Western knowledge and technology at the expense of local culture and society. Western "science" has implicitly been the only means through which development may be achieved. This ideological commitment has simultaneously portrayed indigenous knowledge systems negatively, and associated indigenous ideas, concepts, and methods with backwardness, or portrayed them as an obstacle to "progress". Most seriously, this historic neglect of indigenous knowledge has contributed to atrophy some aspects of indigenous systems for lack of use and application.

Of all indigenous systems that have come under attack, pastoralism as a production system has suffered the most. It has been criticized by the proponents of capitalist economic development using variations of the "tragedy of the commons" argument (Hardin 1968). This characterization led to the implementation of policies that aimed at a total replacement of pastoral indigenous production systems. Ironically, however, the product of this process has been a breakdown in the sustainability of these systems, primarily because of environmental degradation of arid lands, a process we are referring to as desertification.

As shown above, Maasai indigenous knowledge derives from floral biodiversity, whose survival depends on the preservation of a wide variety of plant species that are presently being threatened by changing land-use systems and inappropriate development interventions. Protection of biodiversity and its related knowledge base is essential. In Maasailand, the privatization of rangelands (beginning in the 1970s with the assistance of a loan provided by the World Bank) through the group ranch approach is creating further subdivision, and therefore economically and ecologically unviable units. Needless to say, these shrinking units of land management grow increasingly inappropriate and irrelevant to the Maasai knowledge of the environment and the indicators they use for planning their survival strategies.

Conclusion

This paper has discussed the significance of indigenous knowledge systems, and in particular, the knowledge produced and reproduced among the Maasai. Indigenous knowledge and its associated set of indicators is important in the management, preservation, and conservation of resources of the range for sustainable use. Knowledge of the environment and its resources has served pastoralists well in diagnosing and combating both human and livestock diseases. The depth and extent of this knowledge has persisted in spite of (or because of) inadequate development interventions. The Maasai have retained major aspects of their indigenous knowledge systems, and although some have been retained in an attenuated form, the prevailing robustness of this knowledge is itself an interesting indicator of sustainability.

This paper has also referred to the different ideological perceptions of indigenous knowledge systems which are often incompatible with the scientific, and especially to the tendency for science to ignore and undermine their effectiveness. Development processes in the drylands of Eastern Africa based only on the dominant perception of livestock or human health sciences will fail to achieve their desired goals and objectives. The time has come to learn from pastoral indigenous knowledge systems and understand their relevance to sustainable resource management. As the Maasai say: "*Meishaa elukunya nabo eng'eno*" (one head cannot contain all knowledge).

The Use of Trees, Birds and Animal Behaviour as Measures of Environmental Change by the Shona People of Zimbabwe

Claude G. Mararike

Introduction

In sociological and anthropological literature, we find extensive discussions on the cosmologies of different people, notably the way these people understand the world of their experiences. People have tried to put the world around them in some kind of order: a system to assist them in making decisions on the best way to plan their survival strategies (Beach 1980; Anderson 1988; Connerton 1989).

This article discusses how certain types of trees, birds and some patterns of animal behavior have, for many years, been used by the Shona people of Zimbabwe as measures or signals of changes in the quality of their environment. To the Shona, the term "environment" (*nzvimbo yatigere mairi*) encompasses all things through which human life may be sustained. These may be economic, social, religious, and ecological aspects of life.

Material used in this article was collected from the people of Buhera West in the Manicaland Province of Zimbabwe as part of an ongoing research project about the local people's past and present survival strategies.

Background

To understand who a people are, it is sometimes useful to look at their history. It is, however, not the main task of this article to give a detailed account of the Shona people, as there exists an adequate literature on their ethnography (Beach 1980).

In brief, the Shona occupy the greater part of Zimbabwe, except for the southern and southwestern portions, which are occupied by the Ndebele people. They all speak the Shona language; in the past, all Shona have followed the same traditional political structure and organization.

At the centre of Shona socioeconomic activities is the land, regarded not only as a productive resource, but also as a link between the dead and the living, the present and the past. The land binds the people together. This is why Gelfand, one of the early colonial settlers in Zimbabwe, noted with some admiration the attitude of the Shona people towards their environment:

> Not only must man avoid change, but he must not alter nature more than is necessary for his basic needs ... Not a tree may be chopped unless required for firewood. Nor land cleared unless required for cultivation. No one should hunt an animal except for his own family requirements. So strong is this feeling among the Shona that one entering a strange area in a forest, a mountain or a beautiful spot is not allowed to comment on it least he upset the ancestral spirits (*vadzimum*) of this region. (Gelfand 1972, p. 54).

In Buhera West, but specifically in Ward Six, where most of the data for this article was collected, the dominant ethnic group is the Vanjanja, whose totem is the Moyo (heart) of the Sinyoro (derived from the Portuguese "senhor"). Their ancestors came to the area from what was then Portuguese East Africa (now Mozambique) in the early 1800s. There are also other ethnic groups in this ward. Twenty-seven villages make up Ward Six, each village populated by between 100 and 150 people. The villages should normally be administered by a headman (*sabhuku*), who reports to a subchief (*Ishe*).

Although these traditional leaders are still respected, their authority has been officially taken over by new administrative structures and officials, namely Ward Councilors and the Village Development Committee Chairperson. These new officeholders are representatives of the Zimbabwean state who assume responsibility for development activities in the villages.

This change of leadership, introduced after the attainment of political independence in 1980, was a response to post-colonial relationships between the traditional leaders and the white governments. Traditional leaders were expected, during the colonial period, to present and represent the views of their people to the white administration. On the other hand, they were also expected to report all activities (mainly anti-white activities) to the white Native Commissioners, who had full authority over all activities in the area under their jurisdiction.

Also actively involved in the new sociopolitical administrative structures for rural development in Ward Six, and indeed in other parts of Zimbabwe, are various government extension workers, but notably the Department of Agricultural and Technical Extension Services (AGRITEX), whose main responsibility is to encourage villagers to conserve the environment, and at the same time "teach" them modern farming methods.

Before the arrival of European settlers in the nineteenth century, land was a scarce resource in Zimbabwe. Indigenous methods of resource management and utilization were well adapted to conservation. The Europeans introduced competition for land, because the country was then divided along racial lines. The settlers appropriated land and mining rights, and subsequently uprooted the indigenous people from fertile land to land which was predominantly sandy and therefore infertile. The indigenous people had been used to rotational modes of resource utilization. Wild animals and a variety of plants were among the important components of food security during periodic droughts. The Shona people had also developed a good stock of knowledge about birds, trees, animals, and a wide range of other living organisms in their environment. Such knowledge was either in the hands of a few individuals or many people who varied in age, sex, or occupation. It was handed down from generation to generation either orally or practically through different forms of instruction.

This is the background to this paper on the Shona people's use of trees, birds and certain types of animal behavior as measures or signals of environmental changes.

Trees as Indicators of Soil Fertility

Zimbabwe's main indigenous vegetation type is savanna grassland, found along the central plateau, with semi-arid wooded savanna scattered in small sections of the country. In general, the topography, soils, and climate of Zimbabwe are not suitable for intensive agricultural production. Only 37 percent of the country receives more than 700 mm of rain per year, which is considered necessary for semi-intensive farming.

The spatial distribution of the human population, a direct result of colonial legislation that allocated land along racial lines, is the primary reason for the degraded environment in the rural areas. About 80 percent of household energy needs are met through fuelwood. About 70 to 100 thousand hectares of woodland are cleared for either agriculture or urban expansion every year. Desertification is a tangible threat to this region.

Prior to this land pressure situation, the Shona people were able to determine soil fertility, and also the type of crops to grow in a particular type of soil. This is apparent from interviews conducted in this study with elders in Ward Six, Buhera West. Below is a translated transcript of one such discussion with an elder, who was over 80 years of age, living in the area since 1932, when he had moved to the area from the Masvingo Province in the southern part of Zimbabwe:

C. Mararike: Before one cleared a new, virgin piece of land (*gombo*) for crop cultivation, how was soil fertility and soil suitability to crops determined?

Elder (half-jokingly): Why do you want to know this? Anyway, since you are keen to know, let me explain to you. The type of trees which grew in a place indicated to us how fertile the soil was. For instance, if there were many *misasa* (*Brachystegia spcifornaic*) and *mitondo* (*Julbernardia globiflora*), we knew that the soil was fertile. Such soil would be good for a variety of crops, but maize would do particularly well.

C. Mararike: How did you acquire such knowledge?

Elder: We learned from our fathers. When I say "fathers" I mean all the elders who were in the village. They were our fathers. We asked them many questions. Besides, before a boy could be considered for marriage, he was required to demonstrate that he was ready and able to look after a wife and children by clearing a piece of land, planting it, and then harvesting enough grain to fill a granary. This was a form of apprenticeship training.

C. Mararike: Do you still use this knowledge?

Elder: Where do you think I can use this knowledge? Who wants to hear anything from an old man like me?

C. Mararike: Earlier, you only mentioned two types of trees which helped you to determine soil fertility. Can you mention more types of trees?

Elder: Oh, yes! Where you found many *mikarati* (*Barkea africana*), *mitarara* (*Gardenia ternifolia*) and *mipangara* (*Dichrostachys cinerea*), the soil was generally poor, and therefore not suitable for crop farming. But where you found *michakata* (*Parinari ruratelliofolia*) and *mishuku* or *mizhanje* (*Terminalia sericea*), the soil would be well-drained. Crops such as rapoko, groundnuts, pumpkins, beans and millet would do very well!

From the abridged version of the interview which I reproduced above, a number of interesting and important points emerge. The discussion will return to these points after further examples of other indicators used by the Shona people.

Trees as Indicators of Water Tables and Change of Seasons

In September 1993, I coordinated a three-day multidisciplinary workshop held in Chipadza Village, Ward Six.[16] Among the workshop participants were some 40 villagers. One of the issues which came up for discussion during the workshop was the water shortage in the ward. In follow-up research visits to the area, I collected additional information on the sort of indicators the villagers used to determine the presence of underground water. Certain types of trees were mentioned. For instance, where there were many *mikute* trees (*Syzugium spp.*) and *miroro* (*Annona spp.*), the water table was supposed to be very close. But once these trees began to die, it meant that the water table had dropped considerably.

Trees are not only indicators of water levels in semi-arid zones, but also of impending rain. When *mitondo* trees began to have new leaves, it was a sign that the rainy season was about to start. The first rains were therefore called *mvumira mitondo* which literally means "the rains that give life to the new leaves of *mitondo* trees."

[16] This meeting was held under the auspices of the African Food Systems Under Stress Program, an IDRC-supported project in which the researcher is involved (Mararike et al. 1994).

According to the people of Ward Six (this knowledge is held mainly by women), an abundance of wild fruits in a particular season is an indication of a good rainy season. *Chakata, hute*, and *mazhanje* were given as examples of these "indicator fruits". It should be noted that women normally collected these wild fruits for home consumption: therefore their familiarity with the trees and fruits provided them with this knowledge, which they shared, in turn, with the wider community.

Birds as Grassroots Indicators

It is estimated that Zimbabwe has some 640 different types of birds, 270 kinds of mammals and about 150 species of reptiles. Some of the birds and animal species are used as meat by the Shona. Some of them have medicinal value, while others have various socioeconomic values.

Some forest birds are known at the local level to behave in ways which explain or signal certain events. When a *haya* bird sings in early summer, the Shona believe that it will rain within a day or two. This bird rarely sings: but when it does sing in a particular way, rain comes within a few days.

The *shezhu* (the honeyguide) is well known among the Shona for guiding hunters, or indeed anybody who may happen to be passing by, to a beehive. It uses three distinct calls. On first meeting a person and desiring to guide him to a beehive, it will call without ceasing *"Tse, tse, tse!"* until it gets to the vicinity of the hive. Then it alters its call to just one *"tse"* and continues with this call until the hive is almost discovered. It then alters the call to *"Kwadziya, kwadziya!"* ("It is warm, it is warm!"), meaning that the hive is nearby. Shona hunters say that if you do not reward this bird with some honey, it will lead you to some savage animal the next time!

Local Knowledge

The data gathering on local indicators in Buhera West showed that this knowledge emerges from a complex process which involves social, situational, cultural economic, and institutional factors. It appears to take place on the basis of existing conceptual frameworks and procedures. A number of variables, such as

orientation, interests, experiences, available resources, and patterns of interactions affect the process.

The way the Shona people categorize, code, process, and impute meaning to experiences constitutes their knowledge. To them, a "life world" is the world they live in, defined by them. The everyday life of most people in Buhera West is dominated by the pragmatic motive: to solve life-threatening problems. Is this "necessary knowledge" or "discretionary knowledge?" This distinction is based on custom and habits as well as physiological criteria. If knowledge is known to satisfy certain physiological needs, then it may be considered necessary; if knowledge has been based on custom and habits, but does not necessarily satisfy physiological needs, then it is discretionary. Yet knowledge that satisfies both physiological criteria as well as custom and habits, must be absolutely necessary!

The distinction between "necessary" and "discretionary" knowledge is important because such a distinction affects:

- the form of participation in the accumulation, preservation and the methods used in gathering that knowledge;
- the intensity of participation, that is, the total labour time to which participants commit themselves in the process of accumulating that knowledge; and
- the distribution and sustainability of the knowledge.

Table 14 below shows responses given by 20 randomly selected people in Ward Six. Their responses were not based on any organized observed trends, but rather on what they "knew" and had been told. This research project suggests that it is essential to move from "necessary knowledge" and "discretionary knowledge" by asking local people to record their observations. This approach is necessary so that the accumulation of local knowledge can be documented and used to predict outcomes.[17]

[17] This exercise can even be handled by local schoolchildren in conjunction with their communities and researchers.

Table 14. Necessary Knowledge Responses of Twenty Ward Six Residents Based on Information Shared by Elders

Type of indicators	Necessary	Discretionary
Rooster as timekeeper	10	10
Trees as soil fertility indicators	9	11
Birds as heralds of the rainy season	0	20
Trees as water level indicators	12	8
Abundance of wild fruits as indicators of good rainy season	6	14

In the interview with one of the elders in Ward Six mentioned earlier in this paper, it was clear from one of his responses that he believed (rightly, I think) the knowledge, which elders had accumulated over the years, was no longer needed by the present generation. The elder had asked, "Who wants to hear anything from an old man like me?"

This response has two important implications: one on the way extension work is conducted in the villages, and another on the disregard for existing stocks of knowledge. There is, indeed, evidence to show that extension workers go out to "teach" the villagers, not to "learn" with them or from them. Yet this is a complicated reality for extensionists. At a workshop held in Chipadza Village (referred to in this article), one participant suggested that the agricultural extension officers had probably introduced crops that were not suitable for the area. In response, one elder at the workshop had this to say:

> Oh, yes! That is very true! You! (pointing at two researchers who were asking questions) You are the witches! You are taking us back. You are not making us develop. In times past, my family used not to have problems because I grew a lot of traditional small grains. You are the people who are killing us ... because you are telling us to grow crops that are not properly suited to our soils. (Mararike et al. 1994, p. 31)

The message contained in the elder's complaint is clear. If existing knowledge is removed from the local people, the substitution should be better than what previously existed, or else a blend of what is available with what already exists.

Conclusion

The article has examined local knowledge among the Shona people and their use of trees and birds as measures of environmental change. The rationale behind this paper is to provide a basis on which existing stocks of local knowledge can be viewed, and possibly retrieved.

Existing stocks of knowledge need to be properly documented, to bring out more information on the substantive content of such local knowledge. Questions which require attention include: How do the people know? How is the knowledge passed on? How can this knowledge be lost? How does such knowledge become necessary? How can local knowledge be blended with other external knowledge? In this regard, *how* research is sensitive to the needs of local people is an important consideration, because local people (like anybody else) want to protect their knowledge.

The task of knowledge documentation is, however, limited by the fact that knowledge is often situational, or specific to a particular location: therefore, it is important that the local people themselves be involved in its use and control. Local schools and other similar institutions can play a leading role in the documentation process of indigenous knowledge, because knowledge is sequential. What they lack, though, are resources, such as the capacity to catalogue and store information. We should also not lose sight of the fact that knowledge, in whatever form, is associated with power. Conflicts are therefore bound to arise between and among interest groups at the local level, as well as between "insiders and outsiders," for the control and use of knowledge.

Appendix

- Report of the Workshop on Grassroots Indicators for Sustainable and Equitable Development

  18–19 October 1993
  IDRC, Ottawa

This page intentionally left blank

Report of the Workshop on Grassroots Indicators for Sustainable and Equitable Development

18–19 October 1993
IDRC, Ottawa

The Grassroots Indicators Initiative

Agenda 21 and other outcomes of the 1992 United Nations Conference on Environment and Development (UNCED) articulated the need to bridge the gap between local needs and interests and the broader regional, national, and international contexts of environmental policy and decision-making for sustainable and equitable development. For communities, researchers, development agencies, governments, and other policy-making bodies, responding to this need raises important questions:

- What is the nature of local knowledge about the environment and how is it important to decision-making in the local context?
- How can local knowledge important to decision-making at the local level contribute to broader sustainable and equitable development goals?
- How can the use and development of local knowledge as a decision-making tool (for example, as indicators in environmental monitoring and reporting systems) be supported, validated, and enhanced to enable communities to better adapt to changes in their environments?
- What changes in regional, national and international reporting and decision-making processes are needed to increase their receptivity to local, or "grassroots" environmental indicators, and improve the integration of such indicators within environmental monitoring systems for sustainable and equitable development?

To consider these questions and to propose a practical plan of action for research on grassroots environmental indicators for sustainable and equitable development, IDRC (18–19 Oct. 1993) brought together a small group of researchers, academics, and activists working with indigenous knowledge systems, development information networks, and environmental indicators.

This report summarizes the ideas presented by the participants on the significance, nature, and characteristics of indicators derived from local knowledge used in environmental decision-making. We propose a protocol for grassroots indicators research and networking, and recommend a series of activities to support the identification, development, and use of local knowledge as "grassroots" indicators in the broad context of environmental monitoring, reporting, and decision-making for sustainable and equitable development.

Workshop Participants

One of the principles underlying the grassroots indicator initiative is to credit individuals' ideas, innovations and wisdom, which may derive from personal experience or be entrusted to the person by his or her community. This workshop report acknowledges the contributions of its participants by indicating, within the text of the report, the initials of the contributor in parentheses.

Contact addresses for the workshop participants are listed below.

[EAS] Elizabeth Ardayfio-Schandorf
Professor, Deparment of Geography and Natural Resource Management
University of Ghana
P.O. Box 59
Legon, Ghana
Tel: 233-21-775381 Fax: 233-21-774338

[MB] Michael Bordt
Senior Research Analyst
National Accounts and Environmental Division, Statistics Canada
21st Floor, Section O
R.H. Coates Building, Tunney's Pasture
Ottawa, Ontario
Canada
K1A OT6
Tel: 613-951-3803

[AG] Anil Gupta
Professor, Indian Institute of Management
Vastrapur, Ahmedabad 380015
India
Tel: 91-272-407241, ext. 4927 Fax: 91-272-427896

[HH] Helen Hambly
Faculty of Environmental Studies
York University
4700 Keele Street
North York, Ontario
Canada
M3J 1P3
Tel: 416-736-5252 Fax: 416-736-5679

[BH] Bertus Haverkort
Project Manager
Institute for Low-External Input Agriculture (ILEIA)
Kastanjelaan 5, P.O. Box 64
3830 AB Leusden
The Netherlands
Tel: 31-33-943086 Fax: 31-33-940791

[TH] Tony Hodge
McGill School of Planning, McGill University
MacDonald Harrington Building, 4th floor
815 Sherbrooke Street West
Montreal, Quebec
Canada
H3A 2K6
Tel: 514-523-5797

[YL] Yianna Lambrou
Program Officer, Environment and Natural Resources Division
International Development Research Centre
P.O. Box 8500
Ottawa, Ontario
Canada
K1A 3H9
Tel: 613-236-6163, ext. 2114 Fax: 613-567-7749

[DL] Danna Leaman
Program Officer, Environment and Natural Resources Division
International Development Research Centre
P.O. Box 8500
Ottawa, Ontario
Canada
K1A 3H9
Tel: 613-236-6163, ext. 2358 Fax: 613-567-7749

[HL] Henry Lickers
Director, Environmental Division
Mohawk Council of Akwesasne (MCA)
P.O. Box 579
Cornwall, Ontario
Canada
K6H 5T3
Tel: 613-575-2377 Fax: 613-575-2181

[NM] Nancy MacPherson
Coordinator, Service on Strategies for Sustainability
IUCN
Rue Mauverney 28
CH-1996 Gland
Switzerland
Tel: 4122-9990001 Fax: 4122-9990002

[RPA] Robert Prescott-Allen
IUCN Commission on Environmental Strategy and Planning
627 Aquarius Road
RR2 Victoria, B.C.
Canada
Tel: 604-474-1904 Fax: 604-475-0149

[SS] Sara Scherr
Natural Resource Economist
International Food Policy Research Institute
1200 Seventeenth Street N.W.
Washington, D.C.
USA 20036-3006
Tel: 202-467-4439 Fax: 202-862-5600

[JV] Joachim Voss
Program Director, Sustainable Production Systems
Environment and Natural Resources Division
International Development Research Centre
P.O. Box 8500
Ottawa, Ontario
Canada
K1A 3H9
Tel: 613-236-6163, ext. 2334 Fax: 613-567-7749

[AW] Anne Whyte
Director General, Environment and Natural Resources Division
International Development Research Centre
P.O. Box 8500
Ottawa, Ontario
Canada
K1A 3H9
Tel: 613-236-6163, ext. 2558 Fax: 613-567-7749

We also wish to acknowledge the contributions of the following individuals:

George Greene, Director General, Corporate Policy Development, Canadian International Development Agency (CIDA), who facilitated the workshop; and

Michelle Lobo, Claire Thompson, and Sam Landon, research officers, IDRC, who provided valuable assistance.

Grassroots Indicators: Definitions and Examples

Indicators are pieces of information, or data, that can be used to make decisions based on observed trends toward or proximity to the achievement of specific goals. For example, some kinds of information about the environment can indicate to decision-makers the status of and trends toward (or away from) sustainable and equitable development. In reporting on progress toward sustainable and equitable development, indicators can help policymakers determine whether broad goals and targets, such as those outlined in Agenda 21 are being achieved, and whether existing policies are having the desired effects.

By presenting the following specific examples of situations in which individual, local, or community knowledge is used in environmental decision-making, we hope to derive an organic definition of "grassroots indicators" for sustainable and equitable development, and to articulate characteristics of such knowledge that are relevant to their use in environmental monitoring, reporting, and decision making systems.

Below are some of the proposed definitions of grassroots indicators collected during the workshop process.

[BH] The meaning ascribed to an observable part of a reality by a certain population in order to make decisions about the management of their environment and other survival strategies.

[RPA] An indicator is meant to assess and predict elements of the whole in a reductionist manner.

[HL] An indicator is a threshold value. A signal has a pattern; if there is no pattern then it is "noise." Accumulation of patterns and indicators are a knowledge system.

[AG] Indicators are threshold values, signals, and patterns. Language is of central importance in understanding indicators, which may have one or several terminologies.

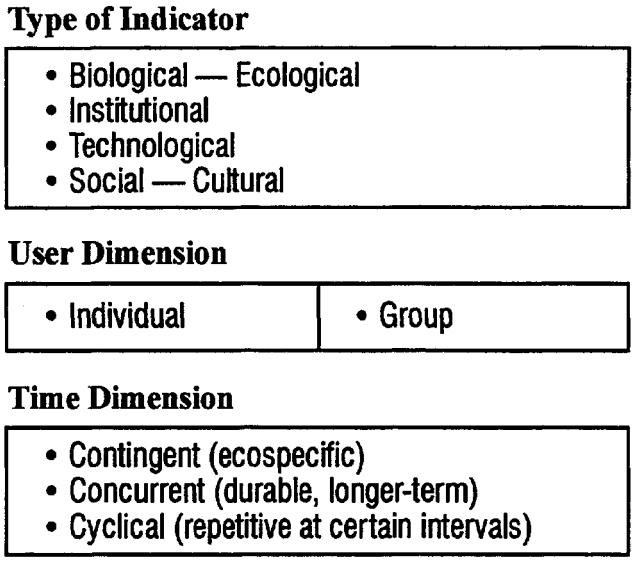
[HH] Indicators are used by decision-makers to monitor the status of ecosystems and to predict ecosystem changes which have an impact on the present and future well-being of people. Conventional indicators are formulated by scientists and statisticians using data collected at both the local and higher levels. Grassroots indicators are formulated by individuals, households, and communities, using their local systems of observation, understanding, and practice, and often involving indigenous knowledge.

[HL] Rather than use the term "traditional environmental knowledge," use "naturalized knowledge," which [allows for] the adaptation of knowledge even by recent migrants and links it to culture which may be in transition.

Numerous examples of grassroots indicators were brought forward during the workshop discussions. The examples listed below use as much of the speaker's original wording as possible.

To facilitate the presentation of these examples, they are grouped into five categories: 1) biological and ecological; 2) institutional; 3) technological; 4) cultural; and 5) social. This classification is also based on the "types of grassroots indicators" suggested by Anil Gupta's three-dimensional model for classifying indicators (Figure A1).

Figure A1. **A Proposed Model for Classifying Grassroots Indicators** by Anil Gupta



Biological and Ecological Indicators

[JV] Bird migrations are used in crop planting decisions in the Philippine highlands.

[JV] [EAS]
Spontaneous plant (weed) growth indicates to African farmers soil qualities such as fertility and nutrient deficiencies, helping them to determine what and when to plant.

[TH] The presence or absence of certain species of animals suggests environmental quality. For example, earthworms in the soil, the activity of bee colonies, the presence of songbirds, the existence of life under rocks, "give a sense of the state of life."

[AG] The flowering of the neem tree (in India) indicates the nature of the coming monsoon before the rains begin. Ants collect their pupae (eggs) three or four days before the monsoon rains arrive, and snakes move into

treetops three days ahead of the monsoon. These local indicators can be compared to the best satellite data which give only 48 hours advance warning. These biological and ecological examples of grassroots indicators can also be classified as individual and concurrent (durable), as in Figure A1.

[AG] Bamboo is planted on homesteads as a windbreak. Its location provides a detailed map of the microclimate by indicating directions of wind and storm movement.

[AG] In Bhutan, the alternating movement of yak and cattle herds between northern and southern pastures is regulated according to the seasonal flowering of a shrub known locally as "tsed." The movement from one pasture to the other requires one month, during which time herds of the different species are not allowed to meet. The simultaneous fallow period and herd separation gives the pasture time to regenerate and prevents transmission of disease between the two species.

[AG] Species ratios can indicate environmental change, such as soil degradation. An increasing ratio of goats to cattle on farms in arid areas can indicate decreasing quality of natural forage, since goats are stall-fed. In southern Asia, an increase in the number of monocot species (such as corn and rice and most other food crops) and a decrease in the number of dicot species (most nonfood plant species, with the exception of legumes) suggest that decreasing amounts of nitrogen and other nutrients are being returned to soils. Other indicators of declining nutrient cycling in soils are an increase in the ratio of shallow-rooted to deep-rooted tree species, and an increase in the ratio of exotic to indigenous plant species.

[AG][SS]
Plant species composition can indicate the status of watersheds. The occurrence of deep-rooted trees and woody, nonedible species suggests the absence of springs and shallow aquifers.

[DL] Dayak people of Borneo, forest dwellers, rely on the taste characteristics of bark and wood to distinguish between species of trees, or to select individuals of one species having more resistance to insect and fungus

attack. The taste characters may be associated with concentrations of toxic chemicals produced by the trees. Wine tasters have developed a similar sensitivity to and terminology for differences in taste.

[MB] Anecdotal information from trappers [in Northern Canada] about their trap lines and distribution of animals is corroborated by satellite data used in habitat mapping. This means of aggregating semiquantitative and qualitative data is useful in geographic information systems (GIS) and was applied in the settlement of northern land claims.

[HL] Changes in the taste of fish have been related to changes in the concentration of effluent from pulp and paper processing in rivers. The ability to distinguish these differences in taste differs between men and women.

[AW] The Ojibwa people used the strange taste of their tea to detect water contamination.

[AW] It is dangerous to separate the indicator from its cultural context. Subsistence farmers in arid areas of Mexico can grow various combinations of corn, beans, and squash on land that varies in quality from lower to higher sites on hillsides. The amount of rainfall in June is a reliable indicator of rainfall for the coming season, and aids their decisions about how much and where to plant. This indicator has an economic dimension: only farmers who can afford to hire oxen for ploughing when the fees are highest can wait for the June rainfall before planting, while poorer farmers have to cultivate earlier [and plant more to cover the risk]. The farmers place higher value on maintaining soil fertility in years of good rain through leaving more land fallow rather than following the Western concept of cultivating as much land as possible. This approach guided the Green Revolution, which largely ignores noneconomic motivations for decision-making.

[AG] Changes in indigenous and introduced rice varieties cultivated in Africa indicate changes in the water table, water flow, and sedimentation.

[HL] There is a 700-year-old prophecy that when the white pines have disappeared from Cornwall Island the world will end. Those pine trees are dying now from fluoride. The world may not be coming to an end now, but time concepts are different for different cultures. A Hota Nashone prophecy states that at some time a spotted animal given to the community will cause the community to die. Also, the Hopi Fourth Age of Man was destroyed by fire — perhaps signifying the nuclear age. An important question is: Can we reverse the prophecy? To mitigate such prophecies, the elders have made sure that the community does not rear spotted deer, and is conserving white pine saplings.

[AG] In parts of Bangladesh, the sweet potato is an indicator of poverty (but this is group- or class-specific); in other areas, it is grown by both rich and poor households (but in this case, the indicator is contingent or ecospecific).

[AG] The presence of particular species of cultivated plants can indicate the age of a homestead. For example, in regions where there is frequent flooding, banana trees must be planted first to stabilize the soil, followed by a manipulated succession of cultivated species that indicate the history of cultivation. This indicator is phenomenological — contingent or episodic (Figure A1).

[AG] The flowering of certain species of bamboo indicates impending attack [upon crops and stored grain?] by rats.

Institutional Indicators

[AG] In drought years, the distribution of small quantities of water in community tanks must be distributed unequally to enable some crops to survive rather than all to fail, while in normal years water can be distributed equally among users. This example demonstrates a cycle of chaos and order in institutional behaviour which violates the notion that equitable distribution of resources is always sustainable.

[JV] In the Philippines, a change in elders' decision-making authority can be seen as an indicator of change in the resources over which elders have authority, and can predict problems in forest management.

[HL] [HH]

Early signs of increases in social violence are indicators of breakdown in traditional society and economy, often linked to diminishing environmental health. Health indicators, such as an increase in infant mortality, can signal social and environmental change.

[AW] There are sets of indicators that are defined within a scientific framework, but rely on local residents as observers. For example, cottagers in the Great Lakes region report blooms of blue-green algae to monitor water pollution. School children in the United Kingdom report the presence or absence of certain species of lichen as an indicator of air pollution. An environmental hotline run by the Environmental Monitoring Centre in Rijnmond, Holland, monitors industrial air, soil, and noise pollution by responding to telephoned complaints from residents based on what they smell, see and hear. In Ontario, there are similar hotlines for monitoring invading species, such as the purple loosestrife, and declining diversity of bird species. Use of local observations minimizes the need of decision-makers to rely on models, increases the sample size by providing a large number of direct observations, and can be converted to action effectively.

[EAS] [AG]

The evolution of institutions over time and space can be seen as a predictor, or indicator of social and environmental change. Note that RPA objects, saying that institutional change is a response to indicators, and not an indicator itself.

Technological Indicators

[AG] The preference of open wells to tube wells is an indicator of aquifers.

[HL] On farms, the complexity of fences indicates the number of generations of development of the farm.

Cultural Indicators

[EAS] Shifts in traditional gender division of household [and farm] labour can indicate environmental change as well as changing cultural systems and values, such as land tenure systems shifting to give greater value to the more extensive cultivation of economic crops more often grown by men, than to the subsistence foods often produced by women.

[EAS] [BH]
Community taboos against the use of particular species of animals and plants for spiritual reasons, or exclusion of sacred groves from certain uses may exist to protect important species and environments. Violation of these taboos can indicate environmental change, in that these violations can have negative effects on land and resources.

[RPA] The availability of an "essential luxury" can be an internal community indicator of whether the community is living within its means. For example, in hunter-gatherer societies, meat is a luxury that is culturally, rather than nutritionally, essential. Personal prestige and reproductive success of hunters is derived from hunting success, and meat is shared throughout the community to establish and maintain social relationships. A periodic scarcity of meat will not cause a demographic catastrophe, whereas shortage of a food staple would cause famine. A shortage of meat is therefore an early warning signal that the community population is too large, to which the response is increased infanticide and use of abortifacients.

Social Indicators

[AG] Changes in the political activity within a society can be a late or early indicator of social change. For example, a small but growing political lobby can indicate transformation in social structures.

[HL] The level of social violence in a community can be related to breakdown in traditional economy, which is more dynamic than just money; it includes the use of language and the practice of rituals, the acreage of land

in use, even the number of young women who can (preserve) their own food. There is a saying: As the women don't can, the level of community violence increases. These relationships are indirect and involve a number of trends.

[HL] The number of outside researchers working in a community is inversely related to the level of concern if it is measured by the amount of money available to the community to carry out its own research.

[HL] The rise of violence in sanctuary areas, such as churches and hospitals, can be seen as an indicator of decreasing social health.

[TH] The spontaneity of children can be seen as an indicator of social and environmental integrity.

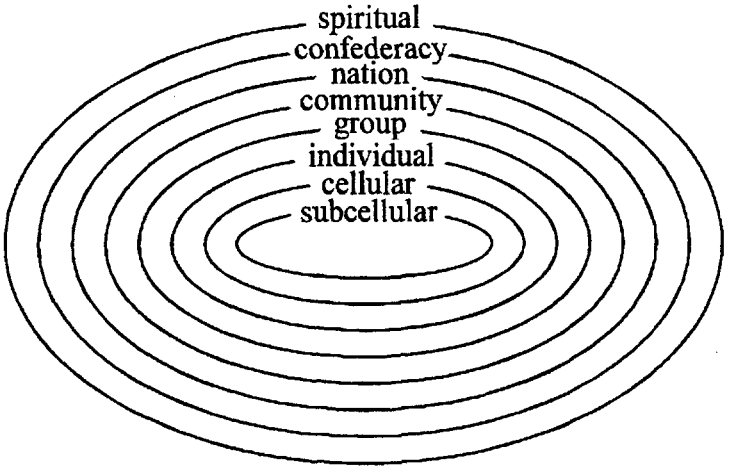
[AG] Conflicts over grazing rights, increasing social tension over shared resources, indicates diminishing quality or increasing pressure on the resource.

Characteristics of Grassroots Indicators

Several characteristics define the nature of grassroots indicators. These include: 1) specificity; 2) types of knowledge systems from which they are derived; 3) source and user; 4) scale; and 5) purpose. These characteristics may overlap. They also vary in usefulness.

The model of cumulative effects – naturalized knowledge systems proposed by Henry Lickers (Figure A2) shares some of the same characteristics. It is depicted on page 145.

Figure A2. Cumulative Effects — Naturalized Knowledge Systems
by Henry Lickers



NOTE: The levels of organization (subcellular to spiritual) can be seen as nested circles representing scale. Each level is affected by change at any other level of organization, creating a ripple effect. Solving a problem requires crossing the boundaries between the circles.

Table A1 (overleaf) indicates that the differences in properties, such as chaos and certainty, distance and time, between levels of organization, show why it is difficult to apply indicators from one level to another, and why any transfer of indicators between levels should move from one level to the next.

Table A1. Cumulative Effects - Naturalized Knowledge System

$$\sum_{n=1}^{n=n+1} C = \Sigma E + \Sigma E^1 + \Sigma E^2 + \Sigma E^3 + \Sigma E^4 + \Sigma E^5 + \Sigma E^6 + \Sigma E^7$$

CAUSE = SUM OF EFFECTS

$\sum_{n=1}^{n=n+1} C =$	ΣE + Subcellular	ΣE^1 + Cellular	ΣE^2 + Individual	ΣE^3 + Group	ΣE^4 + Community	ΣE^5 + Nation	ΣE^6 + Confederacy	ΣE^7 Spiritual
Number of Members of the Group (N)	< 1	< 1	1	5-10	10-10 thousand	10 thousand - 1 million	1 million- 1 billion	$\propto$
Variable	$N*10^0$	$N*10^1$	$N*10^2$	$N*10^4$	$N*10^8$	$N*10^{10}$	$N*10^{12}$	$\propto$
Time Unit/ Scale ($\blacktriangle T$)	< 1 sec	1 sec	min - hours	hours - weeks	weeks - months	months - years	decade	$\propto$
Distance Unit/ Scale ($\blacktriangle D$)	< 1 μm	μm - m	m - 10m	10m - km	km - 10km	10km - 100km	100km - world	$\propto$
Expenditures in $	Billions	Millions	Thousands	Hundreds	Thousands	Millions	Billions	?
Type of Definitions	Properties	Variables	Parameters	Guidelines	Criteria	Laws	Chapters, Treaties	
Certainty	..... Decreases ..... ▶							
Chaos or Problems	..... Increase ..... ▶							
Number of Studies	Small ..... Increase ..... ▶ Large			Large ..... Decrease ..... ▶ Small				
People/ Professionals Involved	Nuclear Physicists, Microbiologists	Histologists, Cellular Biologists, Toxicologists	Doctors, Geologists, Entomologists	Ecologists, Group of Medical Specialists, Geomorphologists, Political Scientists, Accountants	Public Health Specialists, Geologists, Popul. Ecologists, Economists	Health Departments, Administrators, Councils	International Organizations (UN, EC)	Elders

Specificity

Local, or grassroots indicators can be based on universal relationships, such as the seasonal migration of birds and other animals, or the relationships between soil types and plant communities. However, the species involved, their particular behaviours, and the decisions to which the observations lead are often quite context-specific.

For instance, biological indicators are often ecologically specific. Cultural indicators are often specific to an ethnic group, a social class, or a gender or age class. Context is therefore important to the interpretation of grassroots indicators. One example mentioned by Anil Gupta showed that in parts of Bangladesh the cultivation of the sweet potato is a class-specific indicator of poverty. In other areas of the region it is grown by both rich and poor households. However, in this latter case, the indicator is specific to the local ecological conditions.

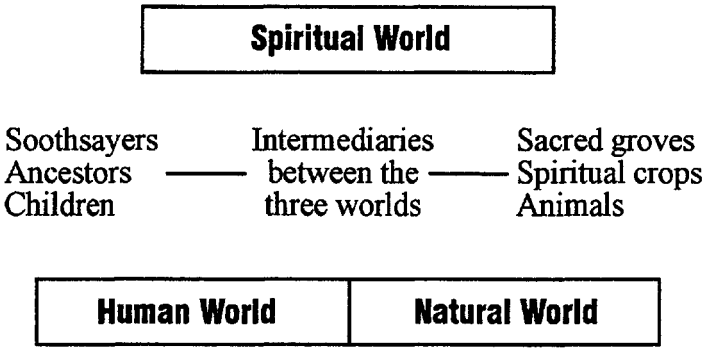
Types of Knowledge

Grassroots indicators sometimes rely on an integrated combination of the nonvisual senses (e.g., taste, smell, feel). These are typically qualitative characteristics that may be difficult to measure or record. For example, Anne Whyte noted that the Ojibwa people use the taste of tea as an indicator of water quality. Similarly, Danna Leaman pointed out that the Dayak of Borneo use the taste of certain bark and wood to identify tree species and indicate their resistance to insect and fungus attack.

This knowledge is often based on a long history of trial and error which continues to evolve over time. It is often transmitted orally, and learning to distinguish meaningful relationships usually requires assisted experimentation, as in an apprenticeship. Such knowledge tends to be transmitted locally, within a particular community. It may also be limited to a specific social group (e.g., adult women, elders, etc.). As Elizabeth Ardayfio-Schandorf remarked, the restriction of knowledge to certain social groups may be reinforced by the perpetuation of "taboos" whose violation may serve as indicators of environmental and social change.

Interpretation of some grassroots indicators is usually based on a particular world view that does not separate the human from the natural and spiritual dimensions of the cosmos, but rather treats the whole as more powerful than the parts. The model suggested by Bertus Haverkort (Figure A3), based on his field experience in Ghana, connects three realms of knowledge which contribute to the formation of grassroots indicators.

Figure A3. Realms of Knowledge
by Bertus Haverkort



Source and User

The knowledge of the relationships on which indicators are based has two sources: that which comes from and is used by the local community, and that which comes from external sources (i.e., science) and is adapted for use by the local people. Within a community, knowledge has two other sources: that which is renewed and refreshed by continuous use, and that which is newly generated in response to new stimuli.

Anil Gupta outlines the use and generation of knowledge in Table A2. Understanding the use and generation of knowledge that underlies grassroots indicators has important implications for their effectiveness at monitoring environmental change and encouraging mobilization around key issues.

Table A2. Generation of Knowledge
by Anil Gupta

	Use	Generation
Local	1. Locally used	Locally generated
	2. Locally used	Externally generated
External	3. Externally used	Locally generated
	4. Externally used	Externally generated

Implications for Monitoring and Mobilization

The local users of particular grassroots indicators may be members of a particular society, or confined to a specific class or group, gender, age, or livelihood (e.g., agriculturalists, pastoralists, hunter-gatherers, fisherfolk). Also, the source of indicators may be specifically rural or urban. Helen Hambly noted that there is a bias towards rural indicators in the literature, and yet urban or built environments are equally important sources of information about environmental indicators. For example, urban agriculturalists used poor yields or unusual plant formations as indicators of pollution and toxins within the city environment.

Grassroots indicators are, in some cases, used outside the communities in which they are generated. For example, Anne Whyte pointed out that in the Netherlands local people may telephone a central environmental "hotline" to report complaints of noise and air pollution. Likewise, local reports of invading species of plants, or declines in bird population, are contributed to the provincial authorities in Ontario, Canada.

Scale

Grassroots indicators often apply to a limited geographic region bounded by the range of plant and animal species, soil types, and cultural boundaries.

Because they are usually based on recurring and predictable relationships observed over many generations, grassroots indicators evolve over time. These indicators are "diachronic," representing a series of observations at a single location over a long period of time. The best examples of this type of indicators are those involving plant, soil, or water quality. As Joachim Voss explained, repeated phenomena, such as bird migrations, help farmers to decide when to plant their crops in the Philippine highlands. Similarly, soil researchers have found that local observations of change in soil colour and structure may indicate change in soil fertility and micronutrient balance.

Purpose

The purpose of grassroots indicators can be moral and persuasive (as in fasting, or a procession), as opposed to coercive or punitive. Indicators can be directed toward management of resources (process) or extraction of a product. They can signal the stock, or state of a resource, or indicate a flow (e.g., of nutrients) within a resource or network. They can be innovative (creating something new within an existing system), or adaptive (recreating something in a different system). They can respond to quite different systems of values: for example, sustainability and social equity, as opposed to maximum yield.

Grassroots indicators are often predictive of change rather than a reaction to it. The amount of time needed to act determines how far in advance indicators are useful, and therefore used. Indicators for planting, such as Mexican farmers' use of rainfall (as explained by Anne Whyte) are useful only before the crop is to be planted. Social violence, famine, and desertification are late-in-the-day indicators, disasters in themselves, not very useful in preventing further disaster. Likewise, as Elizabeth Ardayfio-Schandorf mentioned, taboos against the use of certain plants warn, in advance, of certain environmental change, but once the taboos are broken, they may no longer serve as a prevention against degradation.

Key Research and Policy Issues

Systems of Knowledge

The western scientific paradigm has led in many instances to nonsustainable and inequitable uses of environmental resources. Finding a remedy is not just a matter of finding better tools for conventional science, but will also require a radical change in how science is done, working with both the scientific community and with communities to build links between different systems of knowledge.

Language, culture, and communication are barriers to collaborative research between conventional scientists and communities. Scientists have difficulty understanding knowledge or wisdom that does not measure things in the same way, or in the same language as conventional science, and that requires an understanding of, if not a role in, the local cultural context.

In cases where scientists have recognized the significance of accrued local knowledge, there is often a risk of local people's knowledge being appropriated and commercialized without their permission or compensation. This ties the subject of grassroots indicators to a key issue facing systems of naturalized knowledge — intellectual property rights. Recognition of knowledge rights is implicit in the Draft Protocol for Research and Networking Activities on Grassroots Indicators (page 159).

Anil Gupta has proposed the following matrix for determining compensation for material or nonmaterial and specific or nonspecific knowledge rights (Table A3).

Table A3. Compensation Matrix
by Anil Gupta

	Material	Nonmaterial
Specific	Royalty payment	Recognition Honoraria
Nonspecific	Trust fund	Policy shift Policy reform

Local Empowerment

On-farm research and experimentation by farmers exists, as does community forest and other resource research and management. However, the conventional role of formal science has been to extract, manipulate, and trivialize local knowledge rather than to support and enhance it. There is a great need for participatory research support that respects and builds on the capacity of local people, helping them to overcome the gaps and barriers between the community and national level.

There is a problem of scale and hierarchy, too, in conventional approaches to observation, giving meaning, and decision-making, which suggests that individuals and communities are less important than regions, nations, or international levels of organization. Any assessment of progress toward sustainable and equitable development must consider the costs and benefits of empowerment in the local context.

Empowerment involves several steps:

- support for knowledge networks such as alliances based on kin, certain commodities, trade, gender, language, and culture: these networks cut across the conventional focus on households and communities;
- mobilization and dissemination of information that recognizes both the need to share knowledge and the need to protect it from exploitation; and
- political change.

As Henry Lickers explained, empowerment will involve a process of bargaining, what he referred to as a "zeal to deal." This negotiation requires balancing empowerment with respect and dignity a difficult deal to make. Henry Lickers illustrated his "zeal to deal" in Table A4:

Table A4. Zeal to Deal
by Henry Lickers

	Respect	Equity	Empowerment
Child	Yes	No	No
Prostitute	No	Yes	No
Police Officer	No	No	No

In this example, the child has plenty of respect, but lacks equity; therefore, the child gains little empowerment. The prostitute has equity (cash) but she cannot achieve true empowerment without respect. Finally, the police officer lacks respect and equity, as well as empowerment.

Receptivity of Reporting Systems

In many countries, particularly those in the South, the majority of decisions affecting sustainable and equitable development are made locally to determine the use and distribution of individual or community resources. It might, therefore, be considered that the main source of knowledge for sustainable and equitable development is local people.

The importance of involving community and indigenous knowledge in decision-making processes, like national reporting systems for sustainable and equitable development, is recognized in Agenda 21. However, Agenda 21 and other outcomes of UNCED leave unanswered the question of how such knowledge can be integrated into reporting systems and decision-making processes. The problem is more complex than the identification and recognition of local knowledge (in the form of grassroots indicators, for example) in reporting systems for sustainable and equitable development; the way decisions are made must also be more responsive to, and supportive of, the local knowledge used in local decision-making.

Standard indicators currently used in national reporting systems are selected for qualities that support statistical analysis. These include universality and predictability ("robustness") over space and time; capacity for aggregation

(measurability); sensitivity to the decision-makers' view of the world; and convenience of collection. Grassroots indicators do not commonly have these qualities. Much local knowledge is culturally specific and learned through direct experience. It is often qualitative and anecdotal, and therefore difficult to aggregate. Its implications, for those who do not share the particular culture and environment, are unclear. Finally, it is is seldom found in the mainstream scientific literature, if it has been recorded at all.

The challenge of integrating grassroots indicators into decision-making processes is therefore twofold: on the one hand, how can grassroots indicators be made more acceptable within current decision-making processes, and on the other, how can the decision-making processes themselves be made more receptive to grassroots indicators?

Local knowledge has many characteristics that can enhance decision-making for sustainable and equitable development. For example, it is:

- specific to a particular change or event;
- useful and relevant locally;
- concrete, not abstract or theoretical;
- predictable, because it is based on trends and patterns;
- holistic, responding to signals in their natural context;
- indicative of threshold values;
- based on a need for early warning;
- participatory, self-reliant, and people-oriented;
- based on highly detailed observations over a long time;
- nonevasive, nondestructive of resources;
- directed toward long-term maintenance of resource base rather than maximum short-term production; and
- directed toward individual or group action.

Efforts to improve the acceptability of local knowledge to decision-makers might focus on:

1. establishing credibility (verification);
2. translation and calibration between grassroots indicators and formal scientific knowledge; and

3. in some cases, simplification and demystification of complex, culturally specific information.

Efforts to improve the receptivity of the decision-making process to local knowledge might focus on:

1. methods for aggregating and analyzing qualitative and semiquantitative data: for example, as Michael Bordt pointed out, mapping of anecdotal knowledge of animal distributions from aboriginal hunters and trappers has been combined with wildlife studies in GIS systems to support native land claims and cooperative resource management in northern Canada;
2. methods for translating local responses into broader context responses (e.g., pollution hotlines);
3. development of models that allow for greater variability in the quality of data; and
4. decentralization of policymaking to the local context.

Impact of Change

The evolution and transmission of local knowledge within a particular social and cultural context is the source of its internal potency as well as its vulnerability to change. Local knowledge enables individuals and communities to recognize and adapt to indicators of environmental stress leading to changes in resource availability, and human and animal health, and to evolve strategies to prevent or mitigate the impact of these changes.

However, rapid changes in cultures and local economies diminish the use and transmission of local knowledge. Moreover, rapid and broad-scale environmental change (such as that caused by industrial pollution and deforestation) create stresses beyond the scope of local adaptation strategies.

Research needs in this area include the following questions:

1. How do people recognize and successfully respond to environmental stress through their own actions and strategies?
2. How can communities better cope with and respond to new conditions through

local knowledge?

3. What are the best ways to support the evolution and transmission of local knowledge? and,
4. How can local knowledge be transferred to new immigrants?

Broader Research and Policy Issues

Other fields of inquiry and research that have relevance to sustainable and equitable development beyond grassroots environmental indicators were raised during the workshop. These include:

- the effect of change on common property resource systems;
- constraints on sustainable local resource management (for example, by farmers, pastoralists, fisherfolk, hunter-gatherers);
- support for and revitalization of local experimentation by formal scientific analysis;
- linkages between indicators and value systems;
- local responses to stresses other than environmental;
- institutional and political change as indicators for sustainable and equitable development;
- economic change [and the impact on environment] in resource-based economies; and
- the distinction between environmental and other types of indicators.

An Action Agenda for the Grassroots Indicators Initiative

The October 1993 Workshop on Grassroots Indicators for Sustainable and Equitable Development resulted in the articulation of a list of questions to be addressed:

- How can the knowledge systems that produce grassroots indicators be strengthened and supported? What can be done to strengthen the transmission of grassroots indicators within a community and between communities?
- How can local indicators be included in development programs?
- How can local research skills be enhanced without altering the structure of

local knowledge?

- How can grassroots indicators be used to strengthen national reporting systems?
- Can science methodologies be made more receptive to local knowledge?

Underpinning many of these questions is the critical need for protocols and methodologies that support and enhance research on grassroots indicators and their potential application to all levels of decision making. The workshop participants responded to this challenge by drafting a protocol (page 159) of basic scientific and ethical principles to guide research and networking activities on the grassroots indicators initiative.

Innovative and Practical Activities

Workshop participants recognized that innovative and practical mechanisms are needed to stimulate ideas for, documentation of, and research on grassroots indicators at the local and national levels.

Participants proposed an activity that would invite schools, communities, and NGOs, as well as research institutes to participate in several innovative and practical activities which would help to identify grassroots indicators and assess their usefulness for local and national policy and decision-making. These include: 1) competitions; 2) conferences; 3) research notes; and 4) educational and curriculum development.

- **Competitions** — Local organizations and networks would be invited to develop and sponsor local competitions for ideas and research proposals relevant to grassroots indicators, offering prizes to the best proposals. Results of the competition could provide material for research notes and conference papers (see below) to build an awareness of grassroots indicators within the scientific community. Such competitions could be managed locally in a number of regions, and would be an inexpensive way to identify researchers and research opportunities in local contexts. Competition announcements might be placed in scientific journals (such as *Crop Science*, *The Economist*, and *The New Scientist*). IDRC has funded one such competition through SRISTI in India.

- **Conferences** — Major international science conferences could be a target for presenting papers and distributing research notes on grassroots indicators, thereby influencing how natural science research is done by enabling local researchers to present alternatives at international fora.

- **Research Notes** — A series of research notes on grassroots indicators could provide a means of generating ideas about research needs and priorities, identifying researchers, and stimulating the formulation of new research hypotheses and methodologies. Research notes are less formal publications than monographs — an option that fits in with Joachim Voss' insight that there is usually an inverse relationship between the gloss of a publication and its content.

- **Educational and Curriculum Development** — Support for teachers through training and curriculum development must be both relevant to their needs, and build on what already exists, so as not to perpetuate the current problem of too much curriculum, and too little time and training.

  Proposed activities include small grants to teachers and curriculum development professionals to support the addition of grassroots indicator components in teachers' guides and reproducible supporting materials. Examples of opportunities relevant to this initiative were presented by workshop participants. For instance, Anil Gupta mentioned the science curriculum of the Ghandian educational institutions in India, and Henry Lickers recalled the Canadian federal Department of Health and Welfare ALIVE campaign which is part of the Healthy Communities Project, and the environmental education curriculum developed by the First Nations.

A Draft Protocol for Research and Networking Activities on Grassroots Indicators

1. **Research needs and priorities are to be identified by the communities.**

   Community input can shift the focus and goals of research to demonstrate the utility of local knowledge in decision-making, to identify useful indicators for sustainable and equitable development, and identify gaps in the reporting system.

2. **Research is to be focused on community needs and interests.**

   Communities are capable of identifying problems, issues, and sources of conflict, and of recognizing early warning signals of unsustainable and inequitable development.

3. **Research time and resources will be available to address issues of interest to communities.**

   The interests of the community will not be an add-on or an afterthought, nor will groups within the community with which researchers have found difficulty communicating (e.g., women, children, the elderly, minorities within the community) be shortchanged.

4. **Research done in communities is to be done by the communities.**

   Communities and individuals who are sources of information will be given credit, as will their contributions of time to research. Knowledge based on a long tradition, which has been transmitted by any means, including verbal, will not be presented as "new."

5. **Research results are shared with the source individuals, community, or communities, in the local language, before they are shared with the broader public.**

   The community will have a continuing role in the formulation, presentation, and benefits derived from local knowledge.

Acronyms

AGRIN	Africa Grassroots Indicators Network
AGRITEX	Department of Agricultural and Technical Extension Services (Zimbabwe)
AIDS	acquired immune deficiency syndrome
ALARM	Arid Lands and Resource Management Network
ASALS	arid and semi-arid lands
DDC	district development committee
DRC	district resistance committee
DRSRS	Department of Resource Surveys and Remote Sensing (Kenya)
ECF	east coast fever
ELCI	Environment Liaison Centre International
FAO	Food and Agriculture Organization (UN)
FMD	foot and mouth disease
GDP	gross domestic product
GIS	geographic information system
GLASOD	Global Assessment of Soil Degradation
GNP	gross national product
GOK	Government of Kenya
GPID	goals, processes, and indicators of development
GRIN	Grassroots Indicators Network
GTZ	German Agency for Technical Cooperation
HFS	household food security
ICASALS	International Centre for Arid and Semi-Arid Land Studies
IDRC	International Development Research Centre
IFIs	international financial institutions
IFPRI	International Food Policy Research Institute
IIED	International Institute of Environment and Development
ILCA	International Livestock Centre for Africa
ILEIA	Institute for Low External Input Agriculture
ILO	International Labour Organization
ILRAD	International Livestock Research in Animal Diseases
IMF	International Monetary Fund
INBios	Biodiversity Institute
IUCN	World Conservation Union
MCA	Mohawk Council of Akwesasne

MCF	malignant catarrh fever
MISR	Makerere Institute of Social Research
NAPs	national actions plans (for desertification)
NASA	National Aeronautics and Space Administration
NGO	non-governmental organization
NIEO	new international economic order
PACD	plan of action to combat desertification
PMAMD	provisional methodology for assessment and mapping of desertification
PQLI	physical quality of life index
PRA	participatory rural appraisal
RCs	resistance councils and committees
RIOD	*Réseau International d'ONG sur la Désertification*
RIPS	regional integrated project support
ROU	Republic of Uganda
RRA	rapid rural appraisal
SAPs	structural adjustment programs
SIs	social indicators
UNCED	United Nations Conference on Environment and Development
UNCOD	United Nations Conference on Desertification
UNCTAD	United Nations Committee for Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
UNRISD	United Nations Research Institute for Social Development
UNU	United Nations University
WCED	World Commission on Environment and Development
WRI	World Resources Institute

Bibliography

Adedeji, A.; Shaw, M.T. 1985. Economic crisis in Africa, African perspectives on development problems and potentials. Lynne Reinner Publishers, Boulder, CO, USA.

Adelman, I. 1986. A poverty-focused approach to development policy. *In* Lewis, J.; Kaleb, V. eds. Development strategies reconsidered. Overseas Development Council, New York, NY, USA.

Allan, W. 1965. The African husbandman. Oliver and Boyd, Edinburgh, UK.

Anderson, M.D. 1988. Cultivating pastoralists: Ecology and economy among the Chamus of Baringo, 1840–1980. *In* Johnson, D.; Anderson, D., eds. The economy of survival: Case studies from North East African history. West View Press, CO, USA.

Bauer R. A., ed. 1966. Social indicators. Massachusetts Institute of Technology Press, Cambridge, MA, USA.

Beach, D. 1980. The Shona and Zimbabwe, 900–1850. Mambo Press, Gweru, Zimbabwe. 217pp.

Brown M.B.; Teffen, P. 1992. Short changed: Africa and the world trade. Pluto Press, London, UK.

Chenery H.B. 1974. Redistribution with growth. Oxford University Press, London, UK.

Connerton, P. 1989. How societies remember. Cambridge University Press, Cambridge, UK.

Cooksey, B. 1994. Who's poor in Tanzania? A review of recent poverty research. *In* Poverty alleviation in Tanzania, recent research issues. Dar es Salaam University Press, Tanzania, pp. 57-90.

Drewnowski, J. 1976. Studies in the measurement of levels of living and welfare.

UNRISD Report No.70/3. Geneva, Switzerland. 73 pp.

ELCI (Environment Liaison Centre International). 1994. Réseau International d'ONG sur la Désertification — RIOD: General framework for operation. NGO Planning Meeting, ELCI, Nairobi. 91 pp.

Evers, Y.D. 1994. Dealing with risk and uncertainty in Africa's dry lands: The social dimensions of desertification. International Institute of Environment and Development, Issue Paper No. 48, London, UK.

Galtung, J. 1976. Goals, processes and indicators of development: A project proposal. Peace Research Institute, Oslo, Norway.

Galtung, J. 1978. Goals, processes and indicators of development: A project description. HSDPD-9/UNUP, United Nations University, Tokyo, Japan.

Gelfand, M. 1972. Shona religion. Juta and Company. Cape Town, Republic of South Africa. 80 pp.

George, S. 1990. Ill fares the land. Penguin Group. London, UK.

Gibbon, P. ed. 1993. Social change and economic reform in Africa. Scandinavian Institute of African Studies, Uppsala, Sweden. 361 pp.

Hardin G. 1968. The tragedy of the commons. *Science* 162: 1243-1248.

Hussain, I; Faruqee, M. 1994. Adjustment in Africa: Lessons from country case studies. World Bank, Washington, DC, USA.

Ibikunle-Johnson, V. 1989. The People's Response in Western Uganda. *Convergence* (4): 20-23.

ILO (International Labour Office). 1992. Basic needs in danger. ILO/JASPA, Addis Ababa, Ethiopia.

Kharin, N.G. 1990. Recommendations on application in the Sahelian Zone of the FAO/UNEP Provisional Methodology for Desertification Assessment and

Mapping. *In* Odingo, R.S., ed. Desertification revisited. Proceedings of an Ad Hoc Consultative Meeting on the Assessment of Desertification, February 1990, UNEP. pp. 179-238.

Kipuri, N. 1983. Oral literature of the Maasai. Heinemann. Nairobi, Kenya.

Koala, S.; Krugmann, H.; Rached, E.; Smith, O. 1994. Desertification: the way forward. *IDRC Reports* 22 (2): 4-6.

Krugmann, H. 1994. What do we know about desertification issues, where are the gaps, and where to go from here—An IDRC perspective. Paper presented at the Desertification Donors Meeting, 14 January 1994, New York, NY, USA.

Maliyomkono, T.L.; Bagachwa, M.S.D. 1990. The second economy. James Curry Publishers, London, UK.

Mararike, C.G.; Dzingirai, V.; Pottier, J. 1994. Food Systems Under Stress Project. Report on Ward Six. Paper presented at the Buhera Workshop, September, 1993.

Mascarenhas, A. 1993. Ngorongoro: Perspectives in conservation and management Practices. *In* Rusten, P.; Woien, J. The politics of environmental conservation. Trondhein SMU Report No. 6/93. pp. 40-69.

Mascarenhas, A. 1994. Environmental issues and poverty alleviation in Tanzania. *In* Bagachwa, M.S.D., ed. Poverty alleviation in Tanzania: Recent research issues. Dar-es-Salaam University Press, Tanzania. 201 pp.

Miles, I. 1985. Social indicators for human development. Francis Painter Publishers, London, UK, for United Nations University, Tokyo, Japan.

Miaron, J.O. 1994. Indigenous knowledge: The basis for the Maasai ethnoveterinary medicine. Occasional paper. Department of Animal Physiology. University of Nairobi, Kenya. 76 pp.

Muir, A. 1994. A Situational Analysis of Pastoralism in Semanjiro District, Tanzania. Midlothian, Scotland, UK. 76 pp.

Niamir, M. 1990. Herders' decision-making in natural resources managing in arid and semi-arid Africa. *In* FAO. Community Forestry Notes. Rome, Italy.

Ottichilo, W.K. et al. 1990. Report of the Kenya pilot study FP/6201-87-04 using the FAO/UNEP methodology for assessment and mapping of desertification. *In* Odingo, R.S., ed. Desertification revisited. Proceedings of an Ad Hoc Consultative Meeting on the Assessment of Desertification, UNEP-DC/PAC, Nairobi, February 1990, pp. 123-178.

Potkanski, T. 1994. Pastoral Economy, Property Rights and Traditional Mutual Assistance Mechanisms Among the Ngorongoro and Salei Maasai of Tanzania. International Institute of Environment and Development, Land Tenure Monograph Series No.2. London, UK.

ROU (Republic of Uganda). 1992. Ministry of Finance and Economic Planning. The 1991 Population and Housing Census, Lira District. Entebbe, Uganda.

ROU (Republic of Uganda). 1992. Ministry of Finance and Economic Planning. The 1991 Population and Housing Census, Apac District. Entebbe, Uganda

Ridegeway, R. 1995. Draft: development of desertification indicators for field level implementation: collaboration with UNDP. Monograph. Natural Resources Institute, UK. 42 pp.

Russet, B.M. 1964. World handbook of political and social indicators. Yale University Press, New Haven, CT, USA.

Scott, W. 1978. Measurement and analysis of progress at the local level. United Nations Research Institute for Social Development. Geneva, Switzerland. p. 20.

Sindiga, I. 1994. Indigenous medical knowledge of the Maasai. *Indigenous Knowledge and Development Monitor* 2 (1): 5.

Tandingar, T. 1995. Contrasting traditional pastoral and conventional resource management systems: Are they compatible? Occasional paper. Department of Range Management, University of Nairobi, Kenya.

Toulmin, C. 1993. Issue Paper 42. International Institute of Environment and Development. London, UK.

Turok, B. 1991. Introduction. *In* Turok B., ed. Debt and democracy, Volume 3. Institute For African Alternatives. London, UK.

UN (United Nations). 1994. Convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa. Resolution Adopted 17 June 1994 in Paris, France. United Nations, New York, NY, USA.

UNCED (United Nations Convention on Environment and Development). 1992. Agenda 21: Programme of action for sustainable development. United Nations. New York, NY, USA.

Westendorff, D.C.; Ghai, D. eds. 1993. Monitoring social progress in the 1990s: Data constraints, concerns and priorities. Avebury Publishers. Averbury, UK, for UNRISD, Geneva, Switzerland.

World Bank. 1994. World Bank Environment Department. Dissemination notes: Environment, No. 5, Washington, DC, USA.

WCED (World Commission on Environment and Development). 1987. Our common future. Oxford University Press. Oxford, UK. 383 pp.

WRI (World Resources Institute). 1991. Natural Resource Management Indicators. WRI, Washington, DC. USA.

The Editors

HELEN HAMBLY has been involved in the Grassroots Indicators Project since 1993. She is currently completing her PhD dissertation with the Faculty of Environmental Studies, York University, 4700 Keele Street, Toronto, Ontario, Canada M1G 3P1.

TOBIAS ONWENG ANGURA is the Acting Regional Coordinator of the Africa Grassroots Indicators Network. He is a Research Associate at the Makerere Institute of Social Research, Makerere University, P.O. Box 16022, Kampala, Uganda.

The Contributors

LEMECK KINYUNYU works with the Regional Integrated Project Support (RIPS) in Mtwara and Lindi Regions of Tanzania. Address: RIPS, P.O. Box 113, Mtwara, Tanzania.

NAOMI KIPURI is the Kenya Country Team Leader of the Arid Lands and Resource Management (ALARM) Network, a regional project on pastoralism in Eastern Africa. Address: P.O. Box 24517, Nairobi, Kenya.

HARTMUT KRUGMANN is Principal Program Officer at the Eastern and Southern Africa Regional Office of the International Development Research Centre, P.O. Box 62084, Nairobi, Kenya.

DAN LUBOWA is a Forester with the Forestry Research Institute, P.O. Box 1752, Kampala, Uganda.

CLAUDE G. MARARIKE is a Professor at the Department of Sociology, University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe.

ADOLFO MASCARENHAS is a Professor at the University of Dar es Salaam's Institute of Resource Assessment, P.O. Box 35102, Dar es Salaam, Tanzania.

ROBERT K.N. MWADIME is a Researcher with the Unit of Applied Nutrition, Kabete Campus of the University of Nairobi, P.O. Box 41607, Nairobi, Kenya.

FREDERICK MWESIGYE is a Research Associate at the Makerere Institute of Social Research, Makerere University, P.O. Box 16022, Kampala, Uganda.

WILHELMINA ODUOL is a Lecturer in social anthropology at the Institute of African Studies, University of Nairobi, Kenya.

PATRICK ORONE is a Research Associate at the Makerere Institute of Social Research, Makerere University, P.O. Box 16022, Kampala, Uganda.

MARJA-LIISA SWANTZ works with the Regional Integrated Project Support (RIPS) in Mtwara and Lindi Regions of Tanzania. Address: RIPS, P.O. Box 113, Mtwara, Tanzania.

MATTHIJS DE VREEDE is Program Coordinator of the Elangata Wuas Ecosystem Management Programme, a project of the community of Elangata Wuas, in collaboration with the Biodiversity Centre of the National Museums of Kenya, P.O. Box 40658, Nairobi, Kenya.

About the Institution

The International Development Research Centre (IDRC) is committed to building a sustainable and equitable world. IDRC funds developing-world researchers, thus enabling the people of the South to find their own solutions to their own problems. IDRC also maintains information networks and forges linkages that allow Canadians and their developing-world partners to benefit equally from a global sharing of knowledge. Through its actions, IDRC is helping others to help themselves.

About the Publisher

IDRC Books publishes research results and scholarly studies on global and regional issues related to sustainable and equitable development. As a specialist in development literature, IDRC Books contributes to the body of knowledge on these issues to further the cause of global understanding and equity. IDRC publications are sold through its head office in Ottawa, Canada, as well as by IDRC's agents and distributors around the world.